

August 24, 1959

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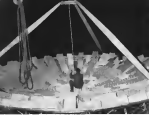
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AVIATION CALENDAR

- Aug. 31-Sept. 2-San Jose, Calif. Institute of Aeronautics (IAA) Symposium and Industry Briefing Session. Hilton Hotel, Dallas, Tex.
- Aug. 31-Sept. 3-Conference on Stratospheric Meteorology, American Meteorological Society, Grafton Hotel, Montego Bay, Jamaica.
- Aug. 31-Sept. 3-10th Annual Congress International Astronautical Federation, Church House, Westminster, London.
- Sept. 1-2-Cosmos, an annual convention in aerodynamics and space flight. The Society of Propulsion Engineers, The American Air Force Office of Scientific Research and General Electric Co., Military and Space Vehicle Dept.
- Sept. 2-4-11th Cosmocon Engineering Conference, University of California, Berkeley, Calif.
- Sept. 3-6-National Convention and Aerospace Exposition, Los Angeles, Calif., Exhibit Hall, Santa Monica Beach.
- Sept. 7-11-1959 Engineering Flying Display and Exhibition Society of British Aircraft Constructors, Birmingham, Eng.
- Sept. 9-10-10th Midwestern Conference on Fluid and Solid Mechanics, University of Texas, Austin, Tex. Sponsors: AFOSR/OSRD, Office of Naval Research, National Science Foundation.
- Sept. 14-15-16th Annual Meeting, Armed Forces Chemical Association, Hotel Statler Hilton, Washington, D.C.
- Sept. 14-16-17th 1959 General Symposium for Allied and Unmanned Aeronautics, Society of Automotive Engineers, Milwaukee, Wis.
- Sept. 14-16-17th Midwest Quality Control Conference, American Society for Quality Control, Sheraton Hotel, French Lick, Ind.
- Sept. 16-17-Western Regional Meeting on Frontiers of Science and Engineering, Inc. (Continued on page 6)

AVIATION WEEK, including Space Technology
August 24, 1959
Vol. 79, No. 8

AVIATION WEEK, including Space Technology, is the most comprehensive and authoritative source of information on the latest developments in the field of aviation. It covers all aspects of the industry, from the design and construction of aircraft to the operation and maintenance of the fleet. The magazine is published weekly, except for two issues which are published bi-weekly. It is a must-read for anyone involved in the aviation industry.



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AVIATION CALENDAR

(Continued from page 3)

- Oct. 17-18—Conference on Effects of Nuclear Radiation on Semiconductor Wafers, Union Auditorium, New York, N. Y. Sponsor: Army Signal Corps.
- Sept. 19-20—National Air Safety (NASC) symposium, Ray Field, Ft. Worth, Ind. Sept. 20-21-19th Annual Conference and Exhibit, Instrument Society of America, Chicago Amphitheater, Chicago, Ill.
- Sept. 21-22—Conference on Planning and Designing of Urban Helicopter Facilities, Institute of Aeronautical Sciences Bldg., Los Angeles, Calif. Sponsor: Los Angeles Chapter of Aeronautics.
- Sept. 21-22—Eighty-first Annual Meeting and Engineering Session, on Development in Service, Worcester Field, Boston, Mass.
- Sept. 23-24—Engine and Operations Symposium, Newark Corp., Millville, N. J.
- Sept. 26-30-1970 National Symposium on Telemetry, Core Auditorium and Whitcomb Hall, San Francisco, Calif. Sponsor: Institute of Radio Engineers. Professional Group on Space Electronics & Telemetry.
- Sept. 30-Oct. 1-19th Annual Meeting, Southern Army Medical Area, Washington D.C. Hotel, Durham, N. C.
- Oct. 1-2-19th Annual Convention, International Northern Aviation Council, Midland Hotel, Portland, Ore.
- Oct. 3-7—Seventh Anglo-American Aerospace Conference, Institute of the Aeronautical Sciences, Reed Hall, New York, N. Y.
- Oct. 5-10—National Aeronautics Meeting Society of Automotive Engineers, the Anaheim, Calif.
- Oct. 6-12—Annual Turbine Development & Operations Conference, Diesel Once Again, Science, N. Y. Sponsor: Bureau of Aeronautics, New York State Department of Commerce.
- Oct. 6-8-12th Annual Meeting, National Business Aircraft Assn., Sheraton Center, Minneapolis, Minn.
- Oct. 6-9—International Symposium on High Temperature Technology, National Convention Center, Detroit, Mich. Sponsor: General Motors, General Motors Research Laboratories.
- Oct. 7-8—Second Advanced Propulsion Systems Symposium, Arnold Hall, Marshall Hall, Boca, Miss. Sponsor: Air Force Office of Scientific Research, Air Force Research Laboratory.
- Oct. 7-8—Fourth Annual National Meeting, Air Traffic Control Assn., Hilton Hotel, Dallas, Tex., Okla.
- Oct. 8-10—Society of Experimental Test Pilots Symposium on Pilot's Role in Space Exploration, Beverly Hilton Hotel, Beverly Hills, Calif. Dated: Annual Meeting, Oct. 10.
- Oct. 11-16—19th National Electronics Conference, Hotel Sherman, Chicago, Ill.
- Oct. 12-16-19th Annual General Meeting of the International Air Transport Assn., Imperial Hotel, Tokyo, Japan.
- Oct. 14-21—"Wilson T-21," Seventh World Wide Interceptor Weapons Meet, Wright AFB, Dayton, Ohio, Fla. Host: Air Defense Command.

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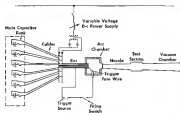
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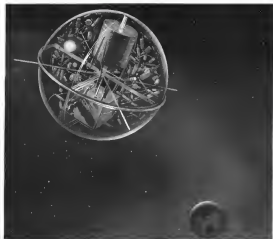
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EDITORIAL

Mr. Khrushchev's Visit

The visit of Soviet Premier Nikita Khrushchev to the United States and the reciprocal visit to the Soviet Union of President Eisenhower are certain to add an interesting chapter to the era of top level interchanges that began in 1958 with the visit of General Twining and other top USAF leaders to the Tushino air show and his grow brother ever since with the Mikoyan, Kozlov, Tupolev visits to this country and the influx into Moscow by Senator Robert Humphrey, Adlai Stevenson and Vice President Nixon. In fact, the traffic of visiting U.S. dignitaries to the Soviet Union has grown so heavy this year that it will be difficult for any candidate in the 1960 presidential race to make much of a case without at least a standard Internet while around Russia under his belt.

What the climate for these interchanges will be like after the Eisenhower-Khrushchev exchange, one can only guess. But we predict that, far from producing a thawing of the cold war and an apparent era of peaceful coexistence, it may have exactly the opposite effect and thus the basic interdependence of the Soviet position into a much sharper focus for the American people and the rest of the world.

Khrushchev: Blurred Vision

For Mr. Khrushchev in approaching his U.S. visit is a mood of reprieve confidence in the economic, military and political power of his country, that has probably blurred the reality of genuine Soviet achievements into over-confidence. It is doubtful if he will be in any mood to back down a fraction of an inch from the standard Soviet position that what happens within the Soviet satellite bloc is none of our business but what happens anywhere else in the world is most certainly Soviet business. We predict that Mr. Khrushchev will be unable to conceal this basic attitude from the American people during his travels no matter how hard he tries to maintain the illusion of "General Uncle Nick."

Mr. Mikoyan almost turned the trick during his U.S. tour but finally lost his composure at a National Press Club luncheon over questions for Soviet actions during the Hungarian revolution and left with the swirling threats of force unless Soviet demands were met. Mr. Kozlov was bluster from the start of his visit and judging from Mr. Khrushchev's discussion with Vice President Nixon and Averell Harriman, increasing belligerence is the current Soviet policy.

We think President Eisenhower and Defense Secretary McNamara have been well advised to allow Mr. Khrushchev a reasonable look at some aspects of U.S. military might. For it is on that point that Mr. Khrushchev is apt to make his most dangerous miscalculation and become a victim of his own propaganda. We think the sight of the Atlas production line at General's Aerospace Division, a look at the Atlantic Missile Range's Cape Canaveral, and a tour of a Strategic Air Command base might provide Mr. Khrushchev with some more realistic data than is currently cranked into his military computations.

It is extremely interesting that all indications so far

from Soviet official sources indicate that Mr. Khrushchev will decline to visit any military installations or production facilities. That may stem from several reasons.

It may be that the Soviet position wants to be in the best "Moscow peace does" mood and feels that any exposure to military facilities would mar this illusion.

It may also be that the stringencies of the Soviet security system, which have really changed little since the days of the czar, preclude even Mr. Khrushchev's throwing open any Soviet missile or aircraft production facilities to U.S. visitors in reciprocity for such visits over here.

The Soviets are surely sticklers for reciprocity on such exchange visits. Until this summer it appeared that U.S. practices were actually more restrictive for Russian visitors than those of the USSR. But this summer the Soviets balked at allowing two Americans to do things that the U.S. had allowed their visitors to do in their country.

The first occasion was the refusal of the Soviets to permit Jacqueline Cochran to fly her personal Lockheed across Siberia to Alaska. It was interesting to note that when Mr. Mikoyan indicated to the Federation Aeronautique Internationale delegates in Moscow that he thought this restriction might be silly and that aircraft should be allowed to fly cross-border, Soviet censorship clamped down and hordled attempts to file this story to the outside world in American newspapers. This despite the fact that some 400 people from 34 countries heard Mr. Mikoyan's remarks in both English and Russian at the FAI dinner. Yet Mr. Mikoyan, Mr. Kozlov and Andriy Tupolev were permitted to cruise from the Atlantic to the Pacific coast in this country.

Stringent Soviet Restrictions

Mr. Twining and his group of technicians also were permitted to see the production lines of the Douglas Thor IRBM and the Convair F-106 Mach 2 interceptor during their tour of West Coast aircraft plants. Vice President Nixon recently revealed that a request for his party to view Soviet missile installations was rejected. It is also evident the Soviets hope to avoid letting President Eisenhower see similar sights.

So it is evident that the much-publicized Soviet promises of reciprocity have practical limitations. Few Americans realize that more than half of the Soviet Union is still off limits to travel by foreigners. And that, even in the open areas, foreigners are not allowed to travel between areas without an accompanying Soviet escort. Few Americans also realize the heavy load of censorship that lies on every news dispatch. Still be foreign correspondents in Moscow at the severe limitations placed on the movements and contacts of resident U.S. diplomats and correspondents, including constant shadowing by police agents and wiring their living and working quarters "for sound."

Mr. Khrushchev's visit should prove interesting both for himself and the American people to whom he will be exposed.

—Robert Hite



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WHO'S WHERE

In the Front Office

Lockheed Aircraft Corp.—Barthel, Calif. has formal upgrade service and maintenance conferences and awards the following appointments: L. Eugene Root, group vice president—sales and distribution; A. C. Kautzsch, group vice president—service; Kenneth J. Buehler, vice president—My Airtel in new product and general manager; Martin and Sport Division; Minneapolis, Calif.; W. A. Feltner, vice president—My Airtel in new product and general manager; George Dornen, Minneapolis, Calif.

Robert C. Jackson, executive vice president, Aero-Astronautical Co., San Diego, Calif., succeeding George C. Woodard. Mr. Jackson will continue as vice chairman of the board. Mr. Woodard is now vice president and executive adviser to the company as financial and business manager.

Philip W. Jones, president and board chairman, Great Air Lines, Inc., succeed by **Leslie H. Hamilton**, resigned because of ill health.

John J. Drapczy and **William T. Sullivan**, vice president, Sonoscorchem, Inc., Hawthorne, Calif.; Mr. Drapczy continues as manager of the company's Mechanical Division, Westbury, N. Y.; Mr. Sullivan continues as general manager of the Los Angeles Division.

James L. Davis, vice president, Aircraft Equipment Division of Consolidated Diesel Engine Corp., Stamford, Conn.

Charles R. Moore, Jr., **Dr. George K. Kautzsch**, and **Henry J. Gray**, vice president, Lorton Industries, Beverly Hills, Calif.; also **William L. Reynolds**, vice president; **Robert M. Klein**, vice president and general manager, Long Electronics, Los Angeles, Calif.; division of Long-Air Electronics Inc.; also **James Rine**, vice president in research and development; **Paul Goodman**, chief engineer.

Robert A. Wilson, vice president, Great Air Lines, Inc., Minneapolis, Minn., and general manager of the Mechanical Division; **William R. Jackson**, head, Development Division, Bureau of Research and Development; **Robert A. Jackson**, head, Westinghouse, Inc., D. C.

Honors and Elections

Westinghouse Electric Corp. has named an advisory committee on research to consist of top management, particularly in the area of new products. Named to the committee are: **Dr. Carl Stanley Smith**, professor of aerodynamics, Institute for the Study of Metals, University of Chicago; **Dr. Julius A. Staggins**, president, Marchmont Institute of Technology; **Dr. I. C. Wilson**, president, General Electric of Technology.

Mr. Gus Ben J. Pank, Commander of the Air National Command's Reserve Wings Center, has been selected as manager of the Air Force Aero's Developmental Management Award for making the most distinguished contribution to management in a position of great responsibility.

(Continued on page 144)

INDUSTRY OBSERVER

Watch for some of the airline firms that bought up small electronic companies several years ago to start using of these properties. AGI Industries, for example, reportedly is looking for suitable purchasers of what is now an air electronic equipment which include the Avion Division in Princeton, N. J., and its Nuclear Products Division and Electronic Division near Washington. Companies with previous experience in the relatively stable consumer or industrial products industries are reportedly disenchanted by the comparatively high percentage of profits which must be plowed back into development in the electronics industry to keep abreast of fast-moving competition.

Lack of funds may force Air Force to cancel several important support system development programs now in their early phases. One such cancelled program may be the AGI's weather forecasting project being developed by Bendix Aviation (AW Oct. 6, 1958, p. 38). Project would make use of a Boeing 707 jet transport.

Larger Air Force thinking on the Decca-Sage program is to merge the efforts of the two competitive teams headed by Boeing and Martin for a joint attack on the second phase of the program with Boeing as the project manager.

The Martin Co., if it can gain Air Force and NASA permission, hopes to try and intercept an orbiting satellite sometime next month. One of its test vehicles developed during Air Force's air launched satellite competition which was subsequently won by Douglas Aircraft would be used to aim the satellite by a predetermined distance rather than try for actual impact. Test would be used to demonstrate the accuracy of the Martin Decca guidance system developed for its ALM-92.

Douglas, meanwhile, has submitted its recommended choice of source contract to develop the aerial guidance system for the WS-188A ALBM for Air Force approval. One report says that Douglas has recommended Aerochem South Atlantic Corp., although Douglas originally had worked with General Electric in its bid for the ALBM guidance contract.

General Aircraft Corp. is designing a triple-thrust version of the B5-12D core turbojet (AW July 27, p. 41) using Allison T56 turbojet engines. Bernard Harcourt, president, says use of the triple-engine configuration will save payload from 1,800 lb. to 2,500 lb. Company is now negotiating with Allison Division of General Motors Corp. for their engines.

The Tart, a small solid-propellant combustion rocket, is now being produced in large quantities at Thokol Chemical Corp.'s Elberton, Md., plant for use by both Air Force and Navy.

Mcgrath-Liaison Co. is negotiating with Computing Devices of Canada for the latter to obtain license rights to build Magna-Dak's M-2 intercept bombing system used in Lockheed F-104s; get license for the built in Canada. Mcgrath-Liaison also has begun negotiations with a West German aviation group (Lear) for M-2 license rights.

Air Products Inc. will produce 7,500 lb. of a new high energy liquid rocket propellant fuel, nitrogen tetroxide, for the Air Force. Material will be used as small rocket engines in an effort to decrease interceptors' thrust-to-weight ratios. A cryogenic liquid, N₂O₄ is expected to prove less powerful than straight liquid fuel but less expensive and easier to handle. Gas is a good research level, N₂O₄ also is of interest as an intermediate step in the development of high energy, solid-fuel rocket motors.

National Research Corp. has secured a \$100,000 Navy Bureau of Ordnance contract for the preparation and "determination of properties" of ultra fine aluminum powder (AW July 7, 1958, p. 25). Fineness of the particles—no more than a wavelength of so much is desirable enables them to absorb large amounts of liquid fuel and to convert rapidly to gas. High surface energy of the ultra-fine aluminum also makes the material attractive as a solid propellant additive (AW Aug. 3, pp. 20, 65).

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Washington Roundup

Soviet Missile Submarines

Adm. Almiral A. Borko gave his official U.S. report on the progress of Soviet missile submarine development at a meeting held before the U.S. is scheduled to have a similar capability. Adm. Borko, who also was present in last week for an unprecedented fluid test at Chief of Naval Operations, indicated, however, that the number and three operational missile submarines are in the next stage and accuracy in the forthcoming Polaris missile submarine weapon system scheduled to become operational in the fall of 1960.

Details and nature of two types of Soviet ballistic missile submarines, both considered drivers of the "Soviet 72" class, were reported by Adm. Borko in the June 15 issue (p. 36). One of the submarines was sighted in an area south of Iceland, the other retired version was seen near Rio de Janeiro.

Twenty-four hours after Adm. Borko's statement, Soviet Fleet, official newspaper of the Russian navy, followed up with a warning that Soviet missile submarines could enter Hudson Bay while Indians be Arctic sea and thus strike U.S. industrial targets from that point. Now at Hudson Bay point is approximately 650 mi. from the northern U.S. border.

High Energy Fuel

Hearings will be scheduled soon by the House Committee on Science and Astronautics on the Department's decision to abandon its program for the development of a high-energy aircraft fuel (AVR Aug. 17, p. 26). Rep. Overton Brooks (D-La.), committee chairman, said it was reported that the Air Force and Navy based their decision in part on the ground that they had no further requirement for the project. "Our committee," he said, "is interested in determining whether it took the services too far and since \$300 million to determine this it was too expensive for the fuel." Brooks added that it was his understanding the National Aeronautics and Space Administration was still interested in the project, and one of the purposes of the committee's action is to determine NASA's plans now that the services have canceled their program.

Soviet Space Equality

Creation of a joint committee on peaceful use of outer space with equal participation by the Western powers was one of the main items of the Soviet Union's proposal to the International Astronautical Federation in London, Aug. 11 to Sept. 5. Another statement that to date equal participation would be results among the Soviet Union to request in future cooperation against the U.S. in space exploration, which could lead to the creation of new autonomous way of distancing the world that are in existence today. He also suggested his proposal be brought to the attention of both President Eisenhower and Premier Khrushchev in an item of discussion and possible agreement when they next meet each other. Prior to their meeting, however, he suggested that the proposal be given consideration by the United Nations and NATO powers.

Another of Andropov's satellite reports would send last week when the House approved a bill to speed

to create a presidential award for scientists. The bill would have the President award up to 20 medals a year to scientists chosen by the National Academy of Sciences for outstanding achievements in their fields.

Missile Management Reports

House Government Operations Committee is scheduled to release a report evaluating the management of missile programs this week. Extensive hearings on Army's programs and on USAF programs under the technical direction of Space Technology Laboratories were held earlier this year by a subcommittee headed by Rep. Chet Holifield (D-Calif.).

Meanwhile, General Accounting Office has abandoned its aim of getting a report on its investigation of USAF management of ballistic missile programs to Congress before adjournment. A draft will go to USAF late in September for comment. GAO launched the investigation when USAF refused to let it review the full report on an investigation by USAF Inspector General (AVR Nov. 16, 1958, p. 34). The USAF missile investigation has been GAO's top-priority project.

SAGE Traffic Facility

Look for the early announcement of contracts between the Federal Aviation Agency, the Air Force, and MITRE Corp. for design and operation of the SATIN-SAGE Air Traffic Integration-experimental facility. SATIN will employ the AN-PSQ-7 (X-11) SAGE-type computer in Lexington, Mass., currently owned out by Lincoln Laboratories. The AN-PSQ-7 (X-11) is one half of the naturally duplicated AN-PSQ-7 SAGE computer installed in electronic centers throughout the United States. The computer will be used to test the full traffic control facilities planned for the SAGE super control system in operation of an integrated air traffic system. Tank capacity, however, will be limited to 100 aircraft because the AN-PSQ-7 does not have the capacity of the AN-PSQ-7A computer. The computer will be used in deployment by 18 super control SAGE centers by, in some cases, Boston Maritime Corp. System are not expected to be completed before 1964.

MATS Jet Fund Gone

Military Air Transport Service lost its second try of the year for jet transport funds last week. Congressional committee committee cut from the supplemental appropriations bill \$15 million which had been added by the Senate after MATS failed to get money for jet transport in the regular Defense Department appropriation (AVR Aug. 17, p. 45). Part of the \$15 million was for development of a new type of the world's largest cargo transport, the jet for purchase of jet cargo transport.

Conference report and coalition among powerful and programs for the cargo transport development development at cause for dropping the appropriation. It also sharply criticized Air Force's position in MATS. Committee said that MATS is necessary and must be preserved and modernized, the conference committee observed that coal aviation "has given by virtue of the program which it has received from the government. It is now a giant goose fed by government subsidies and high rate charges." —Washington staff

NASA May Propose Revised Patent Law

Regulations giving industry greater protection may be asked during next session of Congress.

By Fred Ertman

Washington—Changes in the patent provisions of the 1958 Space Act to give government control of inventions probably will be recommended to Congress by National Aeronautics and Space Administration during its next session, the House Committee on Science and Astronautics was told last week.

John A. Johnson, NASA general counsel, told the Subcommittee on Patent Law and Scientific Inventions of the House Space Committee, that his agency is carefully studying the patent section and probably will submit serious needed changes in the Budget Reconciliation as part of its 1969 legislative program.

Johnson told Rip Tison Mitchell (D-Cal.) subcommittee chairman, that from his personal viewpoint, it is undesirable for an agency such as NASA to be held in a patent law different from that of the Defense Department. He said that, rather than an outright repeal of the patent section, he would favor substitution of the general principles of the National Security Executive Order regarding patents which is similar to the Defense Department policy.

The 1958 Space Act provides that patents obtained on inventions created with work on space projects be private, exclusive, under contract to NASA shall be the property of the government unless a patent is granted.

Defense Department patent practice, which is not provided in law, permits the inventor or the company which is awarded the contract to retain ownership of the patent subject to the license for government use.

Charles the National Security Executive Order provides ownership of patent rights is left to the discretion of the agency, which is directed to take whatever action it sees fit to the public interest. Johnson said that as a result, he would probably legislation along similar lines in which government concerns over its interests in patents is expressed but invention rights are left to the discretion of the administrator who is held responsible to protect public interests.

In this way, he said, there is no invention which would have been left to the government nor would be retained by the inventor in the company with the understanding that it be developed for full commercial use. In the same time, Johnson added, the government would be able to hold title in an invention in which it has great interest.

During congressional consideration of the National Aeronautics and Space Act of 1958, industry representatives, scientists and engineers strongly protested the patent provisions as a hind-

rance to government control of inventions. Contractors complained that these provisions would often bring in a patent law that was not in line with the needs of the industry. They feared that such provisions might result in failure in the first space program.

As a result of these protests, the law passed by Congress contained a joint vote to secure all or part of the government patent rights to inventions under contract to the government. This latter did not result in industry objections and the Administration has been repeatedly urged to modify the contract law.

Johnson said the subcommittee he did not know whether the space program has been held back by the strict patent provisions. He added, however, that a number of inventors have been reluctant to enter contracts with NASA or had requested additional compensation.

NASA Budget

Washington—Congress last week voted National Aeronautics and Space Administration a \$480 million budget for fiscal 1968—\$297 million less than NASA requested.

Research and development had the largest cut, \$83.8 million. Funds for construction and equipment were cut \$62.2 million and funds for salaries and expenses by \$5 million.

While the budget cut, study, research and development \$315 million construction and equipment \$279.8 million salaries and expenses \$91.7 million.

The House originally made a total \$62.2 million cut. The Senate reduced this in full. Conferees of the two legislative bodies composed on the \$297 million reduction.

for the loss of patent rights. He also said he had tried to get out of the situation and that they would accept an NASA contract because of the patent provisions.

The NASA official said there was no way in which the intent of Congress regarding the patent regulations could be recommended but that NASA had estimated the government is in a net loss commercial interest.

Johnson said, for example, that the patent provisions could be used in almost every instance where science was not required but that this was almost not the intent of Congress. Another possible outcome, he said, would be to do all contracting with the Defense Department, which, in turn, would give the contractors with private industry. Since the Defense Department is not bound by law to obtain patent rights to inventions made while under government contract, it could permit the inventor to retain patent rights to a discovery made in his business for government use.

However, Johnson said, NASA as a matter of policy has required the patent clause to be placed in all contracts let by the Defense Department for its agency. Including the patent law, he said, would force the door open for industry, in case of the patent provision. Johnson said the patent provisions let a member of the government in contracting. Most of the companies that do work for the Defense Department are the same firms that are capable of handling NASA contracts as well, making up these groups into a list. There are cases Johnson said where a company may be working on a contract placed by the Defense Department on its own and, at the same time, on a contract NASA had asked the Defense Department to place. He said that is a further he expected this is handled.

Rep. James C. Easton (R-Pa.) said that the subcommittee and also a member of the select committee which helped draft the Space Act last year, and that at the time, the act was drafted, space exploration was not, and that the patent section was provided to protect government interests.

Now that the situation has changed somewhat, Easton agreed that it might be well to review the patent provisions and clarify sections where the language is broad and leaves doubt as to the meaning. He added, however, that government interests in inventions with large potential use by the government should be protected by law.

Sodium Cloud Rocket Launched by NASA

Washington—Investigation of wind activity at altitudes up to 150 m began last week when National Aeronautics and Space Administration launched the first of a series of sounding rockets in a sodium cloud experiment.

Nike-Ap rocket fired from NASA's Wallops Island, Va., station resulted in a cloud of 145 m, trailing sodium vapor from the 30 m, level and leaving a wavelength-sensitive sodium cloud near its peak altitude. Cloud was tracked photographically to provide data on the structure and velocity of winds in the upper atmosphere.

Second that is the series failed when the vehicle disintegrated at the second stage burned, providing no wind data. Further sounding rocket launches have not been announced, but there is a serious lack of wind information in this area, and NASA will undoubtedly continue the program.

Solid-propellant Nike-Ap rocket was used to protect the sodium cloud. This sounding rocket has a Nike-Ap booster in the first stage and a Cooper Development Corp. Apogee as a second stage. The rocket is 27 ft long and weighs 3,190 lb at liftoff.

The 75-lb. pyrolyzed refractor 10 lb of sodium pellets and 15 lb of thermite to vaporize the sodium. A tracer sprays the thermite and sodium, and they start burning at an altitude of about 50 m, exhausting a trail of sodium vapor that produces a sodium cloud in the rocket motor peak altitude.

Sounding rockets the sodium and makes it glow, providing a good target for photographic tracking. The shots are made in clear, moonlit evenings so that, while the cloud is in sunlight at its 150 m altitude, ground observations are not hampered by light scattering in the dark area across the earth.

Sodium cloud used in last week's experiment was produced at dawn and was visible for several hundred miles as it moved generally south and west across the eastern U. S. Best data was obtained in the first 10-15 min after launch, when wind effects on various sections of the cloud were clearest.

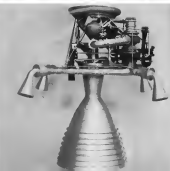
NASA project chief Maurice Dubois points out that this sodium cloud experiment provides information on wind activity at an altitude area where almost no wind data exists.

Data is obtained from the experiment by photographing the glowing sodium cloud continuously from various angles and measuring a three-dimensional picture as it moves with the wind. Wind effects on different parts of the cloud can be measured at set times and positions to determine wind velocity and direction.



Models Show Configurations of Titan Engines

Arrows-General 500,000 lb thrust LR-7 liquid engine (model shown) is for first stage of Mariner-Uranus Titan ICBM. Modelled 500,000 lb thrust version are proposed in second stage, propellant as ARPA's Saturn space vehicle. Arrows second stage LR-9 liquid engine (model below), designed for altitude operation in Titan, produces 100,000 lb thrust at altitude. Titan's propellant gas generator exhaust passes through fins which would deflect together to provide vector power. Titan engines have been 30% reliable to date, according to Arrows.



Control Error Aborts NASA Air Density Satellite

By Craig Lewis

Washington—National Aeronautics and Space Administration failed in its second attempt to measure air density in the upper atmosphere with an inflatable satellite when a control system error kept the satellite from orbiting.

Satellite failed to go into orbit when the upper stage attitude control system apparently malfunctioned, pouring the upper stage and payload downward and to the left. Second and third stage motors fired, driving the payload down into the atmosphere, where it presumably is ignited and not destroyed.

Inflatable satellite in the payload was similar to the Beacon test launched with a Jupiter C vehicle last October. That Beacon failed to orbit when part of the upper stage cluster separated from the vehicle before booster burnout. In January, a similar sphere was launched by a Nike-Cajon to 75 mi. altitude in a successful demonstration of the system and inflation system.

Measurement of air density in the upper atmosphere is an experiment of long scientific interest, and the Beacon satellite would provide reliable data in this field because of its great sensitivity to atmospheric drag. Although

another Beacon shot went on the schedule of upcoming launches, some good that NASA will make another attempt to get an inflatable sphere into orbit.

Last Beacon launch attempt fell because of the high uncontrolled burning of the Explorer VI payload school satellite (JAN. Aug. 17, p. 10). And NASA reports that Explorer VI is broadcasting generally strong and clear signals, although it is still too early to draw conclusions from the data. Solar cells on the satellite's four paddles are supplying the expected current to charge the batteries which power instruments and communications equipment.

The 12 ft inflatable sphere NASA tried to put into orbit was designed as an air drag experiment by the Space Vehicle Group under William J. Oberlin. In this type satellite is about four air drag measurements in the upper atmosphere over its relatively large size and light weight make it quite sensitive to air drag effects.

Varying Frontal Areas

Some type of atmospheric density has been desired from the same satellites already launched, but most of these present varying frontal areas as they move around their orbits and are not well suitable for drag studies. Vanguard I, Vanguard II and Sputniks I are spheres and thus better suited to drag experiments, but NASA points out that the Beacon sphere would be 160 times more sensitive to drag than Vanguard I. The inflatable sphere has a frontal area per unit of mass of 11.3 sq ft per lb while Vanguard I has a frontal area per unit of mass of 170 sq ft per lb.

Beacon Space Vehicle

June II launch vehicle for the Beacon attempt used a modified Aero-Cluster Jupiter IRBM as a first stage, with the upper stages clustered in a spin tub assembly on its nose. The June II was the first to have two upper stages in place of the usual three. Second stage was a pair of 11 solid-dose solid propellant Sergeant rockets. Third stage composed of three of these solid-dose Sergeants was located inside the second stage.

Upper stages were protected by an aerodynamic shield which was jettisoned before second stage ignition. Payload was attached to the third stage, and, after third stage burnout, the rigid shield collapsed, against the fourth stage was intended to start the mechanism for cycling the sphere and inflating it.

Satellite

Guidance was the Delta-Marsman Inertial Guidance System derived in the Jupiter IRBM. It was after the proper first stage with the guidance package in it separated that the control system malfunction in the upper stage diverted them along a steeply flight path. Beacon was jettisoned for an orbit inclined 48 deg. from the equator with a maximum perigee of 420 mi. and a maximum apogee amounting to 1,400 mi.

Payload Weight

Payload weighed 25.5 lb and consisted of a stainless steel cylinder 7 in. in diameter and 31.5 in. long which contained the inflated sphere and its electronics and inflation system. A telemetry antenna was attached to the lower end of the cylinder.

About 11 min. after launch, a trace was in fact found on a sphere in a nitrogen pressure vessel, allowing the nitrogen to expand a bellows and force a piston to expel the sphere from the cylinder.

Nitrogen from the bellows was to pass through a constriction valve after ejection and inflate the sphere.

When the sphere was fully inflated, it would have been detached from the payload. After inflation, the nitrogen was to be bled off to keep the cylinder from acting like a reaction jet in case of a zero-concentric puncture. It would allow its escape through rigidity of its aluminum foil skin.

The sphere designed for the drag experiment was made of Mylar plastic and was thick covered in two layers of aluminum foil 0.5 mil thick. It weighed 16.7 lb. Sphere with its expansion and inflation system was developed by NASA's Space Vehicle Group. Development of all other payload components and payload assembly and checkout was the responsibility of the agency's Jet Propulsion Laboratory and Cooper Development Corp.

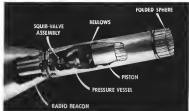
Tracking

Tracking unit in the payload case operated with 60 mw. of power transmitting on 103.03 mc. for a few moments after launch. This signal would have been used for early tracking information on the sphere while it was still sitting close to the payload case. Payload also had two fans which were to operate at 100 mc. and 370 mc. for tracking, but there was no indication they fired.

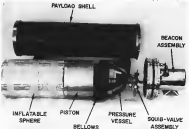
After the sphere and payload case drifted apart in orbit, tracking would have been by light and camera. The aluminum skin would reflect about 30% of the sunlight striking it. A



FULLY INFLATED sphere 12 ft. in diameter is in background; another sphere is being inflated in background from extremely thin sheets of aluminum.



EJECTION and inflation mechanism is depicted in early stages of operation. Nitrogen from pressure vessel expands bellows which pushes sphere out of 35.8 lb. payload case.



PAYLOAD CASE 7 in. dia. x 31.5 in. long. Collapsed sphere occupies 11 in. of the length.



JUNO II nose stage, based on the Army Jupiter IRBM, is tested on launching pad at Cape Canaveral, Fla. Main stage was jettisoned with two high-speed solid propellant upper stages for the Beacon I satellite attempt. Jet Propulsion Laboratory provided those upper stages.



Polaris Fired From Ship Motion Simulator

First, a "first" listing of 10 planes lost while en route from the USS *Observation* Island is scheduled to be made this week at the USAF Alaska Test Center, Cape Caamero, Alaska. The following are the aircraft being of 600 730 tons, on cargo AX test work, the Navy's Ship Motion Simulation Facility (SSMF) at Caamero (above). The simulator facility, which is flown to 500 ft altitude by compressed air. Windtunnel engine tests are run, and test results typically half range. In the test, the first stage engine ignited 1.5 sec. after the engine was powered to release compressed air into the chamber. Officials and the vehicle destroyed AX 15, achieved its test objectives in the launch and downrange field.

villains, such as the world war, goes
cruel, because the brightness of food
and fourth remarkable story.

NASA reports strong, clear signals are coming in from its Explorer VI satellite, but it is still too early for a firm analysis of data on radiation belts, radio wave penetration, etc.

NASA and data received thus far from radiation instruments appears to confirm some facts and considerably alter others about the structure of the radiation spectrum.

Explorer VI was hit by 25 micro-meteorites during its last two days in orbit. Recovery system is working, but it will be several weeks before enough data points have been returned to assemble a picture.

Internal temperatures as well within the design range of 75 to 115°F, and solar coils on the satellite's profiles are charging the batteries as had been expected. Present solar did not require the aid of the small boost heater in the payload, and no decision has been made yet whether it will be fired later.

Raborn Urges Mobile Defense Installations

Others, Gold—Fixed bases in the country represent a "Magnet Line type of military philosophy that is completely and unacceptably ill-suited for the United States of America in the age of the ballistic missile," according to Ret. Adm. William F. Raborn, Navy's Director of Sacred Projects.

Speaking in a group at a debriefing ceremony for a Navy Data Design Laboratory team, he said it is quite possible the Soviet Union is building intercontinental ballistic missiles that can carry an on-ice fixed installation in the United States.

As head of the Polaris project, Adm. Balthus emphasized that the Polaris weapon system is a "single war deterrent" more than it is a retaliatory weapon, and will do its job most effectively if it never has to be used.

"I think it is important," he said, "that we evaluate how we spend our defense dollar and that we don't buy a plausible explanation or plausible defense, anyone which may be wished to our attention by well-meaning politicians."

I believe, are completely willing and eager to have the Polaris weapon system objectively analyzed by people who are interested in their country as the first order of attention and I think, moreover, also when they come through the

No amount of postscript or warning devices that will tell us when the Soviets may have identified their ICBMs will bring about the kind of thing that we want and that is that they should never launch them."

Hebert Group Lists Legislative Objectives

By Katherine Johnson

Washington—House Armed Services investigating Subcommittee will wind up its hearings on charges of contractor influence in military procurement sometime this week, issue a report during

the approaching congressional adjournment and considers legislation needed to implement its findings as the first order of business when the new session convenes in January.

The symposium, headed by Rep. Edward Markey (D-La.) has over 5,000 participants in homes, high-ranking military officers and civilian government officials employed by defense industries, in the major defense contractors and in industry and service associations. The homeing, which began only in July with seminars by Deputy Secretary of Defense Thomas Gotta (AW July 11, p. 51), have represented with a small concentration of the entire field covered by the symposium, which also will be evaluated for the symposium's report.

The objectives of the symposium were to appear to be consensus, but the method of achieving some of them is complicated and controversial. The objectives include:

* First, encourage selling rather than paying to contract in government action as vendors. At present, this is in effect blocked by laws against deal-

ment, selected by state agency and government composition and by party. In general, the law tends to exert effect to an income of \$2,100 a year from government employment plus his retirement pay.

A check by the Army of 500 officers during over the past several months showed an average age of 46 and an average retirement pay of \$390. Under Secretary of the Army Hugh Shelton reported that there is "a great need" for the continued service of experienced

of duty, of the superior officers, who are often compelled to take measures to meet human obligations.

Top-ranking retired officers, including Lt. Gen. C. S. Ivers, former deputy chief of staff for the Air Force, told the senate subcommittee that they would have preferred to continue within the Defense Department structure but that there was no place further to go.

The subcontractor's problem is to decide whether the defense industry work should be kept into the civil service system or whether a separate contract should be established. Rep. Patrick Leahy (D-Vt.) proposes that remaining contractors and vendors now being hired by the defense construction be obtained by the Defense Department itself and assigned to contractors. Leahy pointed out that the government is now paying the salaries of these work force members in contract cost. If several contractors sought the same civilian officer, Leahy says, the service contractor would receive only contractor's work fee cost.

While most in the national defense stream clearly also believe that the film would broaden the base of researchers who are well informed on future military requirements and is a positive

Second, evaluate the appearance of it as well as my actual role that night next to the relation between the military efforts and defense contractors and between foreign military forces and various government officials and their actions.

Subcommittee members have believed the point that the "appearance" must be ended to maintain public confidence and wipe out suspicions that are not, and were related to a month ago when a spontaneous reaction to two defense contracts to build long range tankers, within five days after their retirement, aroused passage, and then only after passage of a study by the subcommittee and a more considered solution.

Congress, with the military, would be the initiator and impose a rapid sale of officers on themselves as ac-

cepting entertainment or employment from contractors. Rep. Carl Vucar (D-Ca.), chairman of the Armed Services Committee, and Rep. Paul Kildee (D-Tex.), chairman of its subcommittee, are mentioned, but need not be.

as an informant, either might have been able to identify that objective. The Hibernia informants were in considerable doubt as to whether they could identify the material that would require a "considerable" period of probably two years before they, former officers, could deal with their former source. *Salomon* and *Steve* were more, however, as are confirmed in the which officers each a low skilled supply. It has been repeatedly highlighted in hearings that a former engineering officer with (math, technical knowledge, the former planner with advance information on strategic plans, or an officer with no military background, might at some times more technical skills and "talents" for their competence than the one least knowledgeable.

In its efforts to eliminate "the symptoms of evil," the subcommittee also has proposed a requirement that former officers who dealt with the Defense Department must publicly register and tell for an end to the practice of allowing contractors to shirk, entrenchment of as a business expense against government contractors.

- **Third, discourage the lobbying activities of Aerospace Industries Assn and the promotional activities of Air Force Assn.** The information already has appeared in cases on this to the executives of defense firms appearing at the hearings who support the two organizations. Few sources of the information have named either group.

contracted to be joined without members expressing their disapproval of AIA's use of dues charged off to government contractors in an effort to amend the registration law (AWM 4 p. 31) and AIA's \$1.2 million annual budget in comparison with \$160,000 for budget of the American Society of Professional Engineers.

- Fourth, minimize public battles between instructors of competing schools, students, which etc. can lead

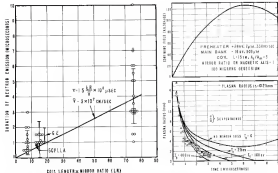
GAO Challenges Convoair

Washington—Training by General Accounting Office that Corvita Dumas of General Dynamics Corp. has denied its investigators access to subcommittee concerning the Atlas KRM 2 and B-1 bomber program set off a flurry of protests from members of House Armed Services investigating Subcommittee last week. The final decision was a subcommittee vote rejecting Frank Pace, General Dynamics chairman, to make the duty available to GAO.

At first, subcontractor services asked GAO to direct Air Force to call off all further payments on Aflac and BSE contracts, until it obtained the data it wanted. GAO recommended against this until a final contract had been made to the company.

In a July 14 letter, Pace asked the Comptroller General that someone, who would be named, be sent to the GAO to discuss the situation. GAO replied that as late as mid-August, Comstock had refused. If the visit to Pace was not effective, Rep. Edward Holtz (D-La.), chairman, threatened to use subpoena power to obtain the information and have it sent to GAO.

communications) is expected to increase both Air Force and Army, for occupying these contractors—Boeing Aerospace Co. for USAF's B-70; Boeing, Intrepid Corp., and Western Electric Co. for Army's Nike Hercules air defense missile—to allegedly generate public concern over possible effects on their programs at a time the Department of Defense was attempting to work out a "master plan" for all defense activities has affected the father of Bremer and Nike heretics.



MANY CURRENTS flow from previously installed areas to magnetic fields. Data was made possible through the use of very strong magnetic fields and very dense plasma. Information from device installation in Kolls is included on error at left.

Space Technology

Navy May Hold Key to Controlled Fusion

By J. S. Bink, Jr.

Washington—Strong probability that a controlled thermonuclear reaction using deuterium has been achieved with scale laboratory equipment at the Naval Research Laboratory was confirmed by the Navy last week.

Results of recent experiments, reported in the *Proceedings of the American Physical Society*, show that the reaction which occurs in the sun and stars and in a hydrogen bomb explosion has been controlled on earth for the first time.

Navy topped its announcement by pointing out that positive experimental proof is still lacking to show that the extremely high heat temperatures of 20,000,000 deg K had resulted in one fusion of deuterium atoms. Positive proof can come only when the velocity of deuterium ions is measured directly. Use of mass spectrometers and other testing instruments for such measurements is so complicated and debatable that it is useless for any positive proof. Navy hopes to get more positive proof of its results when it starts using larger equipment soon planned.

It was the measurement difficulty

which earlier caused British scientists to conclude that the achievement of controlled fusion and use of the thermonuclear reaction. Navy scientists headed by Dr. Alan C. Kolls have reported for several months from making their results public. Working with the financial support of the Atomic Energy Commission and the Office of Naval Research, the Navy group has felt strongly for a time a year that it has been achieving from scientists.

Data Checks

Using accurate standards of experimental results derived from Kolls which permit detection of plasma with shock waves and then compare it to very high densities, the group has eliminated all of its doubts concerning its data. The data was made up to all known cross checks.

These theoretical cross-checks are possible through experimental means. Navy scientists work with a simple spectrograph, X-ray photographs and a scintillation counter. The measurements allow calculations of radiation losses from the plasma plasma device and uniformity, plasma and magnetic pressure and the number of electrons pro-

duced. Such measurements and calculations are well-known methods of studying high temperature gases.

The project of neutralizing reactions to produce a uniformly balanced plasma from the deuterium in sea water and to eliminate the radioactive waste problem of fusion experiments is vital to the deuterium economy, according to scientists connected with the work. AEC statements regarding controlled fusion, however, have been considerably less optimistic in the last two years.

One last note, the AEC now says that the achievement of a thermonuclear reaction in the laboratory was still a considerable length of time away.

One last note, the AEC now says that the achievement of a thermonuclear reaction in the laboratory was still a considerable length of time away. One last note, the AEC now says that the achievement of a thermonuclear reaction in the laboratory was still a considerable length of time away.

In taking a major step toward this goal, the Navy group under Kolls and W. B. Faust said that their major accomplishment was:

• Stable plasma has been consistently produced in their experiments for 5 to 10 microseconds of a second. (Some predictions are that this plasma could last for 100 microseconds to be increased to at least a thousandth of a second to produce power.) This plasma is not ionizing, changing dimensions, under the influence of electric fields, or affected by any other known laws of instability while it produces a shower of neutrons.

• Confined of the plasma and production of neutrons comparable to the Kolls device after the peak magnetic compression has passed. In the absence of any completely new phenomena, the only explanation for the occurrence in a stable plasma is the achievement of a thermonuclear reaction.

The present Navy experiment is performed with a modification of the magnetic fusion device first used by R. F. Post of the University of California Radiation Laboratory. The Post was, however, has dealt with the problem of confining very low density plasmas approximately 1,000 times longer than the NRL experiments. Kolls' use of the magnetic fusion device has been to produce a very dense plasma after first preheating it very rapidly with a shock wave.

The Navy device is a glass cylinder about 12 in. long and about 1 in. in diameter, and it is surrounded by a lens and which has each stronger field on each end than it does in the

middle. The tube is filled with two pure deuterium gas under a pressure of 100 atmospheres in the gas or in the tube lower will cause more action than the pressure of the gas alone.

The superposition of the device begins with the ionization of the deuterium by an RF signal so that it will respond in the absence of a magnetic field.

Then an extremely large current is discharged as rapidly as possible through the coil surrounding the vessel gas. The strong magnetic field that this discharge creates drives the gas to the center of the tube so rapidly a shock wave is produced.

Further Compression

Further compression is produced by the strong fields on each end of the cylinder which have a "sawtooth" effect and reflect the plasma particles back toward the middle of the cylinder so they try to escape from the ends.

Such preheating of neutral gas with electromagnetic control shock waves was first done in 1955 at NRL by Kolls. A number of different methods for producing the shock wave to rapidly preheat plasma to a million degrees or so and then compress it to produce higher temperatures have been tried. The magnetic fusion device has been the best compression method and is used for the experiments which reach 20 million deg K.

The Navy experiment now in use will produce a peak current of about four million amperes by discharging a 285,000 joule condenser bank to create the 20 million deg plasma temperatures. The new equipment, now

planned at NRL, would have a peak current of 80 million amp, a 20 million joule condenser bank and produce a peak plasma temperature of 50 and 100 deg K.

The NRL scientists feel that, if their present results were qualitatively duplicated at such temperatures, there would be no doubt about the existence of a thermonuclear reaction.

It also means that the increased discharge of such large currents, considered in 10 microseconds of a second through a coil about 10 in. long and seven inches in diameter would rapidly the Navy physicists in electrical switching operations of the highest safety.

A number of scientific studies involving fusion experiments are being done by the military, with shock preheating. One group is at the Los Alamos Laboratory of the Atomic Energy Commission, two are in Britain, and France, Germany and Russia have at least one each.

The strong competition between these groups and among all scientists working on fusion devices has been steadily increasing. Kolls went to Oppenheimer, the first nuclear physicist and then to present a paper to the Fourth International Conference on Ionospheric Phenomena in Gales.

West Germans Enter Sidewinder Program

Pass-West Germany will be the dominant partner and a West German company, joint contractor in a new NATO program to build the U. S. Sidewinder as a new missile.

Sidewinder, a subsidiary of the PerkinElmer Corp., is the prime contractor. A score of other companies in the program are included, such as Hughes Aircraft which handles the Dutch part of the program.

West Germany, which will have to supply its own Lockheed F-104G interceptors, will have the largest number of missiles in the program. Other countries involved are Denmark, Greece, The Netherlands, Norway and Turkey.

On a smaller scale than the five-year \$500 million Hawk program (AVIATION WEEK, p. 34), the first joint production agreement formed under the U. S. program followed and financed for such programs two years ago. The Sidewinder contract might eventually run to \$25 million. Total actual cost is \$25 million.

German defense industry, said Boeing as West Germany a total order for approximately 5,000 Sidewinders at \$5,000 each, totaling \$25 million. German will have production under way in next months to 1963.



LABORATORY EQUIPMENT for the Navy controlled fusion studies is among the last equipment now in use. Magnetic fields squeeze plasma under the shock coil with magnetic current on each end. Giant superconducting coils discharge a few microseconds to produce the current field 50 a large mass below this apparatus.

AIR TRANSPORT

Commuter Ticket Trend Gains Impetus

Ticketing system begun by three major airlines may be followed by other carriers to meet competition.

By Glenn Gordon

New York—Recent introduction of "commuter" type ticket plans by three major airlines has started an industry trend that makes other carriers are likely to join whether or not they are thoroughly sold on the idea.

Several major airlines will soon follow and if the plans work out successfully most of the industry can be expected to go along, if only to meet the competition.

Northeast General Airlines has the first airline to introduce a simplified plan for its commuter routes. Capital Airlines and American Airlines had introduced generally similar plans earlier this month in terms of their routes (AWW 7/27 p. 54). All three plans involve the sale of books of 10 tickets, with the customer making his reservation by telephone, filling in flight information on his ticket, and giving the ticket number long at flight time.

The idea of selling commuter tickets has been around for some time, but as Eastern Air Lines official put it, "somebody eventually had to make up his mind to jump into it." Eastern decided to go into commuter-type ticketing within the next few months, despite certain snagging about the plan.

But Eastern isn't the only one into a major ticketing simplification program now under way. This involves use of a new ticket printer, a new IBM airline's computer which will be attached to tickets to permit computer service coordination, and the major leg, eventually an automatic ticket reader which will automate the entire reservation process.

Other airlines whose Eastern probably will use the commuter plan are New York-Washington and New York-Boston. Most airlines use the plan as a ticketing gimmick to help demand, reduce cost and build markets, but Northeast's commuter tickets will be good on all domestic routes and to Alaska and Honolulu. Here is how some other airlines use the commuter ticketing idea. Delta Air Lines is studying the idea but hasn't yet decided to adopt it. The decision will depend partly on how well the plan works out for other carriers.

National Airlines will watch the results of other carriers' experience in a while before going into the plan. It will approve the demand and the problems that come up in connection. No-

tional has been considering commuter service for some time, but did not previously find it economical in terms of demand for the service on National's routes. The airline has been in the commuter-type New York-Boston and New York-Washington markets for only about two years and only recently has reached a frequency level which it feels might justify this type of service. Also under consideration is a plan to link Norfolk to the commuter ticket pattern.

•Northeast Airlines may offer commuter tickets within the next month over its New York-Boston, New York-Washington and Washington-Boston routes. The airline wants to begin selling guaranteed tickets on all some of its routes to ease more travel simplification. According to Nelson Fox, vice president traffic and sales, the airline industry next step will be the ticketing problem as well as the reservation problem, which is closely tied to its ticketing. An objective, Fox said, is to keep at least some points as possible away from the standard ticket structure.

•Delta World Airlines expects to go into commuter ticketing soon, although no final decision has been made. Under consideration are New York-Pittsburgh, Pittsburgh-Chicago, Chicago-Kansas City, Kansas City-St. Louis, Los Angeles-San Francisco, and New York-Los Angeles.

•United Air Lines' sales department is taking another look at the commuter ticket idea, but no decision has been reached. It seems clear, however, that United would be forced to offer a commuter ticket plan if its other transportation did.

•Western Air Lines is studying the introduction of the commuter ticketing, but has no firm plans to go along. It will depend on how the competition reacts.

American's plan next into effect Aug. 15 over its Boston-New York-Washington route and the original

plan was to evaluate the results at the end of October and then consider expansion of the plan. With what a spokesman called "the sort of competitive plan," however, American is almost certain to expand the service after the evaluation. Other possible routes New York-Chicago, Washington-Chicago, New York-Detroit.

American Airlines' ticket director said possible changes of the plan by its users. As an effect of another airline had suggested that the holder of a commuter's book might regret a flight on which he had not made a reservation and surrender a coupon (made out by himself) which secures him advanced space on that flight.

The next would be discussed, of course, but this official didn't like the idea of having to "play a market card." Controlling this sort of abuse, he said, would put the airline back where it started—its former ticket check-in and eliminate the time-saving advantage of the plan.

American, however, says its commuter book contains an explicit American Airlines, who are well known to the airline and can be trusted not to abuse the system.

Regarding variations on the ticketing system introduced in June by Continental with its new Boeing 707 110 jet transport, TWA's "new ticket card" in the new TWA Group with other carriers, but had representatives from Continental scheduled to see how the ticketing, which involves an additional passenger coupon, might work as a working out (AWW 7/18 p. 12).

And Fox of Northeast said his airline is "very definitely" considering an on-flight ticketing plan. Northeast's return will not be similar but will accommodate "all the good points" of Continental's plan.

American, on the other hand, has decided not to go along with the plan. It will stick to its own system of handling passengers and tickets, which has been possible as its own departure business is a profitable addition.

Continental, for the time being, has no plans along the commuter ticketing line. As far as its in-flight ticketing system goes, Continental points out that the plan might not work as well for larger carriers as it might for smaller ones.

Continental's vice president, Continental has found that the extra coupon member is just a little less expensive than one against behind ticket counters to han-



Convair Accelerates 880 Jet Transport Tests

Three Convair 440 jet transports, used in Convair's flight test program, are lined up at San Diego plant. No. 1 plane (foreground) and No. 3 (background) have completed six months test program, both have flown at 605 mph in level flight. The flight test 880 (in center) has completed its initial flight and will be used for service testing on airlines actual airline operations. Federal Aviation Agency certification flights will begin in September, but delivery will be made in November by Trans World Airlines with Delta Air Lines getting its first 440 in January. Development on General Electric CJ610-5 turbojet engines rated at 15,800 lb. thrust also

due the volume of jet passengers would have been.

The increase in ticket counter traffic to Continental is proportionately much greater than to a carrier with more routes to start with, and hence the number of extra counter agents must be proportionately greater. Out of Chicago and Los Angeles, for example, Continental offered about 750 seats a day from each city before jet service began, by Sept. 5 that total will be about 500 seats at each city.

Continental said it has received a number of complaints from travel agents about the new system, on the ground that passengers would be kept from the agents and buy their tickets on the plane. But the airline said only 57 percent of its customers are actually ticketed on the plane. The rest already hold tickets which are picked up by the in-flight agent or rewritten by him if they require changes.

The airline has expected at least a few customers to dispute extra baggage charges, which are collected in a flight by the airline agent. But there have been no complaints, according to Continental.

The carrier said it has sold more than 55,000 worth of tickets on its jets to representatives of other airlines making the flight to check out Continental's service.

Recorder Checked For Crash Clues

New York—Flight recorder recovered from the American Airlines Boeing 707-120 that crashed during a morning flight Aug. 15 with the loss of five crew members now being examined for

several possible clues to the cause of the accident. The jet transport was approaching for a landing on Runway 15 at Cranston Field, Cranston, Long Island.

No emergency had been declared, and the flight had normal landing clearance shortly before going into the ground five or six miles northwest of 500 ft. or higher on the base of evenness records. Investigations were still selling evidence last week and exact circumstances of the plane had not been determined.

From the location of the crash site, the aircraft might have been turning from left to right in final approach. The timing program includes two engine speed approaches.

The aircraft left New York, Teterboro Airport at 1:40 p.m. and went out over the Atlantic Ocean for about two hours of medium and high altitude training maneuvers. It arrived at the Long Island field about 4:30 p.m. and made a no-gear approach without landing, and went around for the approach first was to prove total impact point was 3.2 mi. from the northeast end of the runway and 0.7 mi. west of its centerline. The impact area was 608-780 ft. is distance.

An explosion and fire followed the crash. Killed in the accident were Harry C. Job, 45, the pilot instructor in charge; Fred W. Johnson, 50, pilot; William R. Swain, 49, student pilot; Arthur Anderson, 41, the instrument engineer; and Edgar Freeman, 36, student engineer.

Johnson had 9 hr. 33 min. of actual pilot time on the 707-120, as well as 39 hr. 15 min. of training observer time and 25 hr. 5 min. of line observer time. Swain had 9 hr. 53 min. of actual

pilot time, 34 hr. 57 min. of training observer time, and 25 hr. of line observer time.

Job had been an American Airlines check pilot since 1915. He had more than 2300 hr. on the 707-120. The two engineers being checked out were being qualified for their type rating, which usually comes after about 15 hr. of checking out.

Flying Ticker Completes CL-44 Financing

Washington—Flying Ticker Line last week said it had successfully completed the financing of a fleet of 10 Canadian CL-44H turboprop aircraft for high-altitude mail flying from Canadian Air Mail 18, p. 41).

Proceeds from a private sale of \$5 million of 945 convertible debentures due in 1971 were applied to down payments on the new aircraft. Previously, the carrier had relied for acquisitions on July 1, 1969, an issue of \$15 debentures due in 1967.

Balance of the purchase price totaling \$4.9 million, 80% of which is guaranteed by the Canadian government is covered by equipment trust certificates. The new issue will be Series B bonds convertible into common stock at \$15 per share until 1969. The issue will call for a common stock redemption of 277,770 shares. As of July 1, 1,341,470 shares of common stock are outstanding.

General Dynamics stock bought \$7 million of the debentures. Two mutual funds—Aurora-Hoofbees Fund and First Fund of Boston—bought \$300,000 each and three other funds took the remaining \$3 million.

BEGINNING NEXT MONTH...

A NEW STANDARD OF JET TRAVEL

UNITED AIR LINES DC-8

Next month the great Douglas DC-8 Jet will make its first appearance in scheduled service flying under the colors of United Air Lines.

During the last few months informed travelers have been asking us why—when we could have been the first airline to offer jet service—we chose to do otherwise.

It is a matter of record that we did have that choice. United was the first domestic airline to study, evaluate and order jets. In 1955, after our decision to compare ourselves to a jet equipment program, we conducted an evaluation of the two jet airplanes then available to order.

Our conclusion was that both are exceptionally fine aircraft, but the DC-8 is better suited to our requirements for long-range operation; it is larger and roomier; and built from the ground up specifically for passenger service. That greater flexibility of design has permitted us to incorporate all the knowledge United Air Lines has gained in 33 years of airline operation, as well as to benefit from Douglas' unmatched record of experience in designing and building passenger planes.

In choosing the DC-8 we selected the airplane having the later delivery date. But we

believed that this was far outweighed by long-term benefits for the passenger in added roominess, seating luxury, quietness, comfort, convenience, and many other advances made possible by the DC-8.

In one of the most thorough flight test programs ever conducted in commercial aviation, which began during the Spring last year, the DC-8 has proved to be a worthy successor to a long line of dependable Douglas airplanes including the DC-3, DC-4, DC-6 and DC-7.

Along with the development of the aircraft itself has gone a careful program of preparing United Air Lines for the Jet Age—in personnel training, in new methods and techniques for weather analysis and reporting, communications, ground handling, in-flight service, and all other phases of our operations.

The product of all this extra time and extra care will segment not only a jetliner that is the largest and the newest by four years, but in our judgment the finest as well—a standard of jet travel that will not be equaled for years to come.

On your first flight, we know you will agree that the DC-8 was well worth waiting for.

W. A. Patterson

PRESIDENT
UNITED AIR LINES

Trunklines Heading for Record Profits

Washington—Domestic trunklines, backed by the most prosperous fuel bill cuts in their history, are now averaging for all time higher net profits for the year.

Barring an unexpected reversal of the spectacular rise in passenger traffic recorded over nearly six last, airlines are strong that the industry in 1959 will top the usual \$65 million in net profits set in 1955. Thus far, even the mid-air strike, which began in mid-July, has failed to dent the upward trend in traffic growth.

Net earnings of the 12 trunklines for domestic operations during the six-month period in June reached \$29.5 million. Net profits for the same period last year totaled only \$7.9 million.

Operating revenues also rose sharply to a new high during the six-month period, a direct result of 1959's an available recovery of traffic growth following an 18-month period of business doldrums during which time traffic volume remained stagnant. However, expenses continued to rise, and in fact, threaten the rate of return the airlines had to maintain to back the \$3 billion jet equipment program now in progress.

Lack of the 12 trunk airlines showed an increase in both revenues and expenses during the period. Only Capital Airlines and Northeast Airlines reported net losses for the period.

American Leads Industry

American Airlines led the industry in earnings with a net profit after expenses and special amounts of \$8.6 million. United Air Lines, despite much loss in expenditures for equipment, was the second highest profit maker, with a net of \$7.5 million for the six-month period including a gain of \$476,000 in net fuel sales.

According to United President W. A. Patterson, an 11% increase in passenger revenues was attributed to a "general upward trend in the industry." He noted that coach traffic had increased 27% during the six-month period, while first-class passenger rates dropped 5% from the 1958 level due to a planned reduction in air freight schedules subject to jet competition.

Trans World Airlines reported a nine-month net profit of \$3.9 million before taxes, as compared with a loss of \$13.4 million for the nine-month period in 1958. Tighter management control over expenses and Boeing 707 operations were cited as the reasons behind the sharp reversal in the company's financial results.

Airline net sales for the industry had an all-time high during the six months, although the month-to-month

increase during the period was not as marked as it had been in years prior to 1958. Basic Airlines, which reported an 11% rise in revenues, adjusted schedules during the period to hold available seat miles 45% below the 1958 level. Net income for the ground was \$3.8 million compared with \$503,000 during the first six months of 1958.

Capital's operating revenues climbed 15% in the first half of 1959 over the same period last year. Although the airline reported a first half loss of \$633,000, an operating profit of \$150,400 and a net profit of \$122,000 was reported in the second quarter of the year.

Western Air Lines showed first half earnings of \$1.8 million, while Northwest reported a \$1.8 million net profit from both domestic and international operations—a 308% increase over 1958 earnings.

Why the Increase

Generally, most critics attributed the increase in revenues and profits to the expanding traffic markets developed by the attraction of the jets and to the moderate price increases and advertising campaigns that have accompanied the introduction of turbine power. Several airlines, which have not yet taken delivery, on one equipment list that has been included by the rising sales efforts of the carriers, which have started take-up and turboprop service.

In addition, the rapid monthly increases in coach revenue passenger miles during the first six months, compared to a steady fall in first-class revenue

passenger miles, lead a number of observers to believe the airlines are now narrowing, regarding the large volume travel market.

Eastern Air Lines showed a nine-month net gain of \$7.5 in total operating revenues. Failure to realize a larger increase was attributed "particularly to the multiple competition imposed by the CAA on Eastern." The airline said that the reason is because of cost experience could be attributed to the two fare adjustments authorized by the Civil Aeronautics Board.

Eastern expects to enter turboprop competition early in 1960 with the first of its Douglas DC-8s. United and Delta plan to inaugurate their DC-8 service early this fall.

Delta Report

Delta reported net earnings for its domestic operations of \$1.6 million during the first six months of the year. On the basis of a fiscal year ending June 30, the carrier reports nationwide net profits of \$4 million for the year. Operating revenues reached a new high at \$101 million—a 17% increase over the \$86 million for the previous fiscal year. Expenses were held to a 10% increase.

C. F. Woodman, Delta president, attributed the improvement in earnings to strains experienced in competing air lines, the effect of passenger fare increases and the general recovery from the 1958 recession.

National Airlines, which reported a sharp increase in passenger revenue miles for the last year (AW July 13, p.



An-10 Shorts Moscow-Simferopol Schedule

Aeroflot An-10 transport transport loads passengers for one hour from Moscow to Simferopol, country flight takes 3 hr. Note passenger windows in wings extending from mid-bus engine nacelles (AW July 6, p. 34), cockpit upper modification of two vertical fuselage windows. Five seats 40 passengers and a transport for two from gas fields and dirt runways. It has truck-bed load loading door for cargo and has extremely short takeoff run and high initial rate of climb (AW July 27, p. 47).



Weather-proof silicone rubber seals last longer than organic rubber...reduce costs

Organic rubber seals fail rapidly when exposed to the sun's ultraviolet rays, while with sheet or tube Fluorene used in the rubber to give low temperature flexibility both don't increase the seals to harder and crack and bend to mating surfaces. Fluorene not only changes the necessity to redesign an design and

CRS silicone rubber seals on the other hand provide excellent resistance to the destructive attack of sunlight, heat, weather and ozone. Though usually lighter in cost, silicone rubbers in actually more economical in the long run due to a superior performance of properties, which assure a more permanent, more dependable seal. Silicone rubber with high tear, flex and abrasion resistance, offers

a far long weather exposure, is most economical for many aircraft support equipment applications.

The advantages of silicone rubber have long been recognized by aircraft manufacturers and it is used extensively on all commercial and military jet aircraft in the form of inflatable canopy seals, inter-compartment seal/pneumatic seals, airframe and engine seals, internal seals, door and window seals, cockpit and control cables.

CHR specializes in the comprehensive fabricating and development of silicone rubber seals for jet aircraft and missiles. An skilled fabrication of silicone rubber can be used with fabrics, Teflon® or metal, we can help you solve your sealing problems. We serve your inquiry



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May 27, 1978

767, earned a net profit of \$1.6 million during the first six months of the year. Last year's annual net profit above that of its two direct competitors on the New York-Florida route, due principally to the service operated with Boeing 707s leased from Pan American.

Nation's operating revenues climbed from \$14.7 million during the first six months of 1978 to \$17.5 million in the same period this year.

For the industry, operating revenues during the six month period climbed to \$2.99 million from \$737 million in the same 1977 period. Operating expenses totaled \$141 million this year compared to \$111 million last year.

In the international field, Pan Am's revenue reported net income after taxes of \$612,000 for the first half of 1978 as compared with a loss of \$1.6 million in the first six months of last year. Net income in the second quarter of the year was \$3.1 million, compared with \$1.7 million in the 1978 period.

Four Carriers Propose Military Airlift Boost

Washington—Four U. S. airlines last week asked the Civil Aeronautics Board for permission to confer with U. S. government agencies on development of a plan to expand the commercial airlift of military cargo and passengers.

CAB announced board approval to discuss the plan with Defense Department and other federal agencies. It was to exempt the carriers from anti-trust laws which restrict these firms acting in concert with one another. The four carriers involved are Northwest Airlines, Pan American, World Airways, Seaboard & Western Airlines and Trans World Airlines.

Points the carriers want to discuss with the Defense Department are:

- Expansion of government commercial airlift of military cargo and personnel in the most economical means of aircraft—a large fleet of modern aircraft which would be readily available in emergency as well as in peacetime.
- Establishment of fixed routes for military air transportation services.
- Guarantee that continuity of the air transport pipeline will be maintained during emergencies.

The program is the latest effort on the part of the airlines to win a larger share of military traffic moving over international routes. The plan is similar to one proposed by Seaboard & Western (AWJ July 20, p. 32).

According to the carriers, the plan conforms to a Defense Department policy which calls for "extension of a service that is always available and reliable, and even when the profitable and profitable, in cases as well as in periods of aerial traffic."



COCKPIT VIEWPOINT

By Capt. R. C. Krohn

Jet Training Flight Hazards

The recent crash of an American Airlines Boeing 707-420 jet transport while on a training flight must surely raise once again cockpit spectrum regarding the adequacy of our pilot training programs. At the time, the 707 was practicing emergency landing procedures in the plane of the training program that included landing with two engines out. Even as some airlines, as well as some people within CAB and FAA seriously question whether this particular game is worth the candle.

There are CAB statistics available on training accidents. One can learn, for example, that over the past 13 years the industry on training flights alone, have managed to demolish about 45 aircraft and killed 27 crew members. Some of these accidents might have happened on any flight were there were sufficient, engineering design faults in the airplanes and various other things. But on the whole, these statistics tell us that training is dangerous. And we already know this.

Reduce the Risk

Still, we can hardly drop the matter. We must find out if it is possible to reduce the risk. Obviously the very nature of the test is a handicap. Training implies lack of knowledge, which means mistakes which begot trouble. So the overall risk can't be reduced. It seems that we are faced with an industry problem which will take time and searching and hard searching and much objective discussion to resolve. Although I speak in generic terms, there is no section of aviation that is immune to the training disease.

So here are some random thoughts. Do we know how much time is accomplished in our training? An Air Force pilot has made considerable use of such devices, but on the whole I do not believe that their findings have had much influence on the airline industry—a condition which seems that we are wasting valuable information. Among airlines, both United and Pan American have made extensive use of training devices and elaborate simulators. Their knowledge being put to good use?

Qualified Teacher Needed

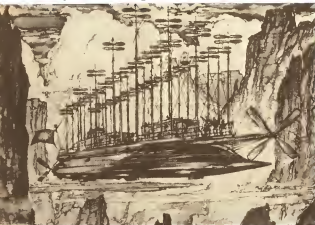
The expenditure of money, time and effort does not, of course, guarantee high achievement. Personally, I have the feeling that we are expending more on the case for good teachers. Indeed, I often think we place all ground school classes in somebody who will take the job. Yet, qualified teachers should make up the bulk of "work" in a training program.

Numerous training accidents, such as the recent American crash, seem to occur during low level, partial power maneuvers. Are these accidents? Must not have been around the local airfield in 1975 and Douglas DC-8 with two engines out? From this reality produce a safer pilot? On the whole, pilots seem to have little difficulty in coping with power failure during actual operations. But in the probable course of training or on the check ride, the hazard becomes magnified, and trouble often results.

Certainly, I would not make a plea for less training. Quite the opposite. It would appear that pilots should have the opportunity to acquire even more flight time in high performance aircraft. And not just commercial pilots either because the data of one-time operators are gone.

If I were the president of an airline, I believe I would be extremely concerned about who was in charge of my training plan where 57 million aircraft were concerned. I would not settle for less than my best operating man, who would have the best teachers and make use of all existing information. And I would not pinch his budget. Above all, however, I would keep asking "Is there a better way?"

Propulsion through the ages...



"Ballon dirigeable" illustrated by Jules Verne, 1858

An outstanding proposal in 1933, dawn of the jet age, Professor Samuel P. Langley, then Secretary of the Smithsonian Institution, dreamed of the transatlantic route, and with good reason. Models of his "aerodrome" had successfully flown over the Potomac. Langley was the first of the pioneers with a thorough grasp of his design — a 34 hp engine turned two pusher propellers. Two attempts were made to fly the full scale machine from the Washburn Houseboat in October and again in December 4, 1903. Each time it plunged into the river. An official report cited the launching catapult as cause of the

failure. Nine days later the Wright brothers flew "Gladstone" over the banks of the Potomac, but the world's most experienced manufacturer of turbo-propellers, manufacturer of American aerobility. Rotor Incorporated. For other sales service on turbo-propellers in North and Central America and Caribbean service. Their 100 cubic inch capacity propellers throughout the world assist in the rebuilding of Rotor turbo-propellers, standard equipment on the Vickers Viscount, Fokker F100, Cessna 440, Cessna 441, and many others.

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Rotor Incorporated after-sales service throughout the United States provides immediate spare parts delivery, technical advice on propeller operations and applications.



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SHORTLINES

► **British Overseas Airways Corp.** will begin New York-Tel Aviv, Israel, service via London and a continental European point in November. British European aircraft will be used, with de luxe and economy seating from New York to London and Tel Aviv and tourist class from London to Tel Aviv.

► **Continental Airlines** flew an estimated 70,454,830 revenue passenger miles last month, a 77% increase over the 39,775,902 figure logged in July, 1958. An all-time freight and cargo record of 127,000 tons was set in July, 1958, to 417,000 tons in the year.

► **Emery Air Freight Corp.** had \$3,265,011 in revenues during the second quarter of 1959, a 44% increase over the same period last year. Adjusted net income after taxes amounted to \$108,751. First full revenues for the air freight forwarder were \$6,264,317 last year, compared with \$4,491,210 during the full year of 1958. Net income for the 1959 period was \$338,924, or 71 cents per share.

► **Frederick B. Ayer & Associates, Inc.**, has purchased the remains of six of the 38 Douglas DC-78 aircraft being converted from passenger to freight configurations by American Airlines. The company has in both first and second class configurations and will be marketed along with the Douglas DC-6A and DC-6B aircraft. Ayer is currently selling and leasing. Conversions will be done by Northwestern Airlines Service Co., division of the Garrett Corp.

► **Board of Airport Commissioners, Los Angeles**, has approved two contracts for improvement and development at Los Angeles International Airport. The first contract for \$117,045 goes to MacArthur Brothers, Culver, Calif. for reconstruction of International Gateway 351, and includes widening 6,000 ft. of existing present with concrete. Second contract for \$15,963 provides for extension of south taxiway K.

► **Pacific Northwest Airlines** carried 17,341 passengers a total of 1,554,898 revenue passenger miles during July, an overall increase of 6% over July, 1958. The airline's air cargo rose 7% to 135,935 tons.

► **Post of New York Authority** has authorized an expenditure of \$1,213,000 for construction of a 1,100-ft. extension to the east end of Runway 138-111, which will make it 14,600 ft. long.

AIRLINE OBSERVER

► Domestic transline traffic continued its spectacular climb in July with the 12 carriers reporting a strong 64.54% load factor. Although July's revenue passenger miles totaling 2.6 billion dropped slightly from June's 2.61 billion, the July figure represented a 12% increase over the 2.35 billion revenue passenger miles flown during July, 1958. Available seat miles in July reached five billion to set a new record for the industry. Thus for the year, load factors have held above the 60% mark in every month except February when the figure dropped to 57.32%. (For earnings breakdown see p. 41.)

► Heavy impact of terrorist operations on the moving public is indicated by the market activity of Pan American common stock following the release of a Boeing 707-120 transport to Moscow last Monday shortly after taking off for Buenos Aires. Immediately after the incident was reported, Pan American shares moved in activity and closed the third most active on the New York Stock Exchange, Boeing closed fifth in volume standings for the day. Both stocks showed losses of one point.

► Capital Airlines will make a decision on its re-equipment program within the near future. The carrier now is close to completing its retooling plan to modernize the program which will include Lockheed Electra and Convair 440s. Active discussions between Capital and Hughes Tool Co. are still under way covering the possible purchase of a part of the fleet of 38 Convair 440s Hughes has on order for TWA.

► **Post of New York Authority** takes a dim view of broadcaster's proposed effort to steer crowds away from airports during emergencies by including information on bulletins describing the incidents. Anita Tobias, Post Authority executive director, has set strict instructions to radio engineers: "do not bring the baby out to play" up his own. National Association of Broadcasters recently met with Federal Aviation Agency and volunteered to pass for each wingman as part of emergency bulletins (AVW Aug. 3, p. 35).

► **Accident**, the Soviet state-owned airline, in another step toward converting its fleet to all-turbine power (AVW Aug. 3, p. 40), has replaced two-engine Ilyushin IL-14s with 80 passenger IL-18s on the route between Moscow and Frunze, central Asian capital of the Kirgiz Soviet Socialist Republic. The three-weekly IL-18 flights cover the 2,650 mi. run in about five hours.

► **Pilots flying for airlines** involved in the recently-established Air Union (Air France, Alitalia, Sabena and Lufthansa) have formed a European Federation of Airline Pilots "to protect pilots' professional interests within the Air Union itself." Lufthansa pilots have said as yet officially joined the group, which is to be called Eurowings. They have agreed to be in complete contact with it. KLM pilots will attend Eurowings sessions in October.

► **Nigeria** has replaced all beatings on all three turbo-prop engines that have been subjected to track maintenance. Due to handling of beatings, Nigerian engineers have determined that most shock on track slightly between New York and Washington was the direct result of engine failures on Allegheny's Canadian 540s (AVW July 27, p. 27). Plans have been scheduled earlier with Allegheny for the past few weeks without any indication of further beatings on the engine. All engines are now being serviced directly from England to Washington.

► **Pan American's Boeing 707-320** turboprop service from Los Angeles and San Francisco to Tokyo, scheduled to begin Sept. 5, is sold out until mid-October.

► **Rolls-Royce** has increased the thrust of its Conway turbofan engines from 16,500 lb. to a maximum guaranteed thrust of 17,500 lb. 14 months ahead of schedule. The engine has been specified for the Douglas DC-6 aircraft purchased by Trans-Canada Air Lines and Boeing 707-420, ordered by Air India, British Overseas Airways Corp., KLM and Varig.

► **New emphasis on promotion** to attract tourist and vacation markets is beginning to pay off. Stage opening in the sale of package vacations during the first six months of the year is being reported by most major carriers.



Focal point of United's operating late a briefing room, capabilities can be quoted about entire system.

United Center Gears for DC-8 Integration

Denver—United Air Lines will soon heavily open its briefing room fairly here by a key factor in the integration of its fleet of Douglas DC-8 turboprop transport into scheduled service next month.

The briefing room located at United's operating base serves as a standing overview of all operating and maintenance activities of the airline. It is a managerial command post where late-night operating facts and figures are placed from every segment of the system and then compiled into an up-to-date statistical record of the company's overall performance.

Running Account

In that task, a running account of the airline's overall operating status is constantly available. In fact, the briefing room's wall charts and maps to permit management to correct inefficiencies and anticipate performance deficiencies. United President W. A. Patterson has on his desk one more running account summary of the briefing room's records showing traffic statistics, operating performance, gross revenue and profit for the preceding midnight-to-midnight 24-hr period.

Each point of the briefing room is as large as 10 ft wall map covering the company's 14,000 sq. miles. extensive cockpit lights on the map help use instantly to indicate weather conditions and other operating factors at various terminals.

The map is flanked by panels of lights approximately 8 x 8 ft in size. Complete summaries of operating performance for the previous 24-hr period are posted on the panels—a detailed

record showing engine, aircraft, status and flight performance, enroute down and cancelled, delay, maintenance and arrival statistics and traffic records. The room is enclosed with glass walls so that the various segments of the base also stand up-to-the-minute records throughout the day without actually entering the room.

briefing sessions begin promptly at 8:00 a.m. Monday through Friday and are attended by managerial representatives from all departments including personnel, economic controls, finance and property. Actual records on the board panels are posted every 24 hours after a shift.

Sessions are conducted by four specialists, who review operations for the past 24 hr, and outline plans for the next 24 hr period. Operating discussion is presented by a meteorologist who delivers weather forecasts for the next 24 hr and personnel weather trends. Those which have influenced operations throughout the system and which may continue to affect flight movements in the period ahead.

Flight Program

As a transportation, passenger service, ground service, passenger control, cargo service and payload control are not excluded from the detailed scrutiny in the briefing room. United's flight operations and other departments United places a high value on the effect such information has in keeping passengers informed on the anticipated progress of their flights.

A maintenance and overhaul schedule follows the meteorologist. Some items of equipment coming aircraft

scheduled for service and those out of service for engine and maintenance repair is presented. Status of aircraft and engine overhaul work of United's maintenance base in San Francisco also is included in the review.

'Deficiency Patterns'

United officials here are convinced that the expanding phase of the briefing will be of major importance in establishing "deficiency patterns" in the breakdown stages of the DC-8. At present, the procedure limits emphasis to put these factors in the context of a flight in operating efficiency by studying problem patterns as they develop.

For example, briefing records disclosed that in May the Captain Wright R3590 engines for the DC-7 experienced 11.6 removals per 10,000 enroute hours. The highest was in December while the Pratt & Whitney R3590 engines on the Comair and DC-7 types performed a relatively normal record of 2.6 removals per 10,000 enroute hours. The upward trend was immediately checked following a further analysis and study of the R3590 engine performance record.

In another case, a rash of engine generator malfunctions which was causing a flight delay in certain flight performance was brought to light by the records. Statistics indicated a problem pattern that spotlighted deficient outlets at the source of the generator breakdown. A new type of switch was introduced to eliminate the particular problem.

Traffic lineups are listed in how long the morning session, which last

about 15 min. The traffic specialist considers an airborne service problem and requests solutions adaptable to no-weather, traffic and operational considerations. Since engine service problems generally arise from operational problems, a close coordination between the various engine departments—most rare in the airline industry—exists at the time as data are viewed out.

Traffic summaries include current load factors, number of passengers carried, number of flight segments completed—close to 95% at the present time—requiring and in route flight performance factors.

Equipment Availability

A flight operation specialist takes over following the traffic briefing to outline availability of equipment for regular routes plus charter or extra services or equipment. Operating plans for the next 24 hr are presented in detail.

The session closes with a summary of the main items discussed, which are filed on a screen by an assigned person.

Referring records not only serve the airline as a means to determine the history of daily and monthly activities but also act as a valuable source of information in economic matters and weather, traffic studies and future use for the airline before Civil Aeronautics Board hearings. Each daily record is permanently filed in series files.

Data also are used by the sales department in drawing sales programs and advertising programs to strengthen weak traffic areas. Sales planning programs are developed according to traffic flow dictated by the records. Now scheduled are revised whenever the briefing room records indicate a weakness in any area or make necessary.

Referring facts information is available to all managers and top executives, personnel and pilots. The role of the briefing room records is to monitor in guiding future events and maintaining top efficiency and effectiveness at the airline's performance.

Communications Flow

Despite the fact that since 1960, 100,000 flights are estimated from roughly 1,500 telephone messages received daily from United stations, the airline has made very few changes in communications representatives in developing the program. Field departments rely on the employed, and most telephone messages used as copies of messages relating to flight dispatch, weather, load planning, maintenance, status coordination and auxiliary service.

In effect, basic information stems from the passengers and how they are treated. A perfect top-to-bottom, no-weakness is filed meticulously and run freely without misinterpretation and



DOUGLAS DC-8 jet transport in United Air Lines markings makes takeoff for another in a series of flight tests. United has 40 DC-8s on order at a cost of \$225 million. Aircraft's four T401-17 turboprop engines provide thrust of more than 40,000 lb.

draw little attention from those serving the briefing room charts.

It is the regular flight that remains the major attention of management and calls for more than a simple readiness of figures. Statements detailing the costs of the trip, the time of the connection, other jobs in progress, most importantly the report.

Briefing Room

The briefing room is a clearing house of information for the airline. Data fed in through the various operating, traffic and sales departments is reviewed to those departments in a completed format of each day's operation. This format, United officials feel, will provide them with the constant check on jet operations that will permit a smooth introduction of DC-8 flights into the present scheduled pattern.

FAA Lists Federal 1960 Airport Funds

Washington—Federal Aviation Agency has set a Sept. 1 deadline for the filing of requests for airport construction aid. Funds totaling \$123 million for fiscal 1960 and 1961.

FAA has encouraged state and territorial applicants that airports will be "adequately served" in line with the agency's policy of stressing federal aid projects needed for increased air safety.

Such stress as acquisition costs of land for airports and runways will not be eligible for federal funds, according to FAA Administrator Elwood Quigley, and airport construction projects will be limited to buildings considered essential to safety. Those include air-

port traffic control towers and facilities needed for weather reporting, communications, fire fighting and crash equipment, plus a limited amount of public use space in terminal buildings.

FAA says its allocation of aid funds available has been divided roughly for the two fiscal years into \$61 million eligible for projects only now.

Money from fiscal 1960 federal aid funds are appropriated in regional states:

Alabama	\$844,149
Arizona	\$832,241
Arkansas	\$792,800
California	\$2,721,261
Colorado	\$687,787
Connecticut	\$504,914
Delaware	\$444,616
District of Columbia	\$1,012,111
Florida	\$1,012,111
Georgia	\$1,012,111
Idaho	\$444,616
Illinois	\$1,012,111
Indiana	\$444,616
Iowa	\$444,616
Kansas	\$444,616
Kentucky	\$444,616
Louisiana	\$444,616
Maine	\$444,616
Maryland	\$444,616
Massachusetts	\$444,616
Michigan	\$444,616
Minnesota	\$444,616
Mississippi	\$444,616
Montana	\$444,616
Nebraska	\$444,616
Nevada	\$444,616
New Hampshire	\$444,616
New Jersey	\$444,616
New Mexico	\$444,616
New York	\$444,616
North Carolina	\$444,616
North Dakota	\$444,616
Ohio	\$444,616
Oklahoma	\$444,616
Oregon	\$444,616
Pennsylvania	\$444,616
Rhode Island	\$444,616
South Carolina	\$444,616
South Dakota	\$444,616
Tennessee	\$444,616
Texas	\$444,616
Vermont	\$444,616
Virginia	\$444,616
Washington	\$444,616
West Virginia	\$444,616
Wisconsin	\$444,616
Wyoming	\$444,616



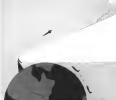
PEACE TAKES A LOT OF WATCHING!

That's why the U.S. Navy will send eyes aloft to scan the seas and skies beyond our shores. The eyes, with this special kind of vision, are early warning aircraft. Many will be WF-2 "Tracers", produced for the Navy by Grumman.

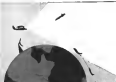
WF-2's "see" via a saucer-shaped radome that houses super-sensitive, long-range electronic detection equipment. Operating from aircraft carriers far out at sea, "Tracers" patrol the extremities of our defense perimeter. And, detect the approach of aircraft or missiles that might invade the privacy of a nation's peace.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

Bethpage • Long Island • New York



Low flying "looney" aircraft in position to scan undetected by ground radar beams, as the diagram shows the range of ground-based radar beams on horizon line the horizon.



Detection range is increased appreciably when the radar detection equipment is within direct line of sight of the ground installation.



The range and effectiveness of radar detection is enhanced dramatically with WF-2's operating off the coast, mobile and long-range aircraft carriers at sea.



■ Washington	\$500.00
■ Alaska & Oregon	\$425.00
■ California	\$380.00
■ New York	\$750.00
■ Miscellaneous Areas	\$17.000.00
Total	\$10.000.00

Tuition appointments are

■ Alaska	\$125.00
■ Hawaii	\$150.00
■ Puerto Rico	\$140.00
■ Virgin Islands	\$120.00
Total	\$535.00

PanAm to Convert 10 DC-7Cs for Cargo

New York-Pan American World Airways will convert 10 of its 25 Douglas DC-7Cs aircraft to cargo configuration under a \$2.5 million contract with Lockheed Aircraft Service Inc. The program will begin next month at Lockheed's Ontario, Calif., base and the first converted plane is expected to go back to PanAm in December. The rest will follow at the rate of about three a month.

The eight DC-7Cs will cruise at 480 mph and can carry 16 tons of transatlantic cargo compared with 750 mph and 31 tons for the new DC-8/A one which operated in the airline. PanAm says it has no plans for dropping of the DC-6As.

Pan American plans to put its first cargo DC-7Cs into the Atlantic, with the Pacific and then Latin American. However, receiving the later aircraft that this sequence depends on Military Air Transport Service contracts and other traffic developments. The airline

noted DC-7Cs probably will be used as the Military for a time, although some may be converted later.

Idlewild Impresses Tu-114 Crewmen

Crew members of the Russian four-engine Tu-114 which visited New York (AW July 6 p. 18) were impressed by the facilities at Idlewild International Airport.

On returning to Moscow, First Commander A. P. Yakovlev described Idlewild as "a huge airport, equipped with the last word in technology." He commented on how many planes "take off and land simultaneously at one time of the day or night under very limited weather conditions" and the convenient facilities on Idlewild's "apron" where aircraft can wait at least 2,500 meters long, with an eight-meter construction.

Yakovlev noted particularly that the crewmen "ing" disappointed at Idlewild to bring the Tu-114 to its landing position had all the power necessary to use the apron. (Just ahead of the Yakovlev was a Pan American World Airways turbine with a 25,000 lb. drawbar pull used to Shift Heavy Cargo.) He recalled that when the Tu-114 landed, they shortly before each of them, but to use the Russian transport had sufficient power to do the job and that two days working together finally brought the Tu-114 to the ramp.



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Santa Monica, Calif.



The care and feeding of a missile system



It takes more than pressing a button to send a giant rocket on its way. Actually, almost as many man-hours go into the design and construction of the support equipment as into the missile itself. A leading factor in the reliability of Douglas missile systems is the company's practice of including all the necessary ground handling units, plus detailed procedures for system utilization and crew training. This complete job allows Douglas missiles like THOR, Nike HENECULES, Nike AJAX and others to move quickly from test to operational status and perform with outstanding dependability. Douglas is seeking qualified engineers and scientists for the design of missile space systems and their supporting equipment. Some immediate openings are described on the facing page. Please read it carefully.

Alfred J. Cernik, Chief Design Engineer, discusses the ground installation requirements for a series of THOR-boosted space probes with Donald W. Douglas, Jr., President of **DOUGLAS**

MISSILE SYSTEMS ■ SPACE SYSTEMS ■ MILITARY AIRCRAFT ■ JET ENGINES ■ LARGE TRANSPORTS ■ AIRCRAFT ■ GROUND HANDLING EQUIPMENT



707-320, 720 Forward Fuselage Sections Compared

Forward fuselage sections of the fast United Air Lines Boeing 720 turboprop transport is set alongside, between the forward fuselage sections of two 707-320 jet-powered airliners. Total length of the short to medium-range 720 is 134 ft. 2 in., as compared with 152 ft. 11 in. for the intermediate-range version. The fast 720 will be rolled out of Boeing's Renton, Wash., plant in early fall and will be delivered to United on April, 1960.

Atlantic Missile Range—Part I

Space Spurs Missile Center's Growth

For 14 months, satellites have been beamed into orbit around the earth, space probes have been fired toward the moons and around the sun, and the

In 1956, 11 contractors employed

In 1940, Bayand had a population of 16,142. In 1990, when the center's average population stood at only 836

The three of wind-rage stations stretching northward almost to Meers as a fortunate accident of geography, from the standpoint of light monitoring and control. Two more, however, from the spotlight power of

Mayor Gov. Donald N. Yates, who



Cape Canaveral was first used in 1957 for a Titan Able flight. During cargo work and for telemetry, loading and symmetry are similar, a derrick and effectively closed the cargo beyond Afterside. Ships have been used for telemetry, loading and symmetry work, a derrick and effectively closed the cargo beyond Afterside. Ships have been used for telemetry, loading and symmetry work, a derrick and effectively closed the cargo beyond Afterside.

A 130-passenger airliner



flies 5,000 miles at 400 mph...

...AND BRISTOL SIDDELEY SUPPLY THE POWER

One of the largest manufacturers of motive power units in the world, Bristol Siddeley Engines Limited produce the Proteus.

A turboprop in the 4,000 hp class, the Proteus powers the Britannia airliner in service with RAF Transport Command and ten airlines all over the world. The Proteus is perhaps the most dependable engine in the air today. It reached an overhaul period of 2,000 hours in under two years—a rate of increase never before achieved by any other engine, piston or gas turbine. Proteus derivatives have been designed for use as turbo-generator powerplants and as marine turbines.



BRISTOL SIDDELEY ENGINES LIMITED



POWER FOR THIS

AND THIS

...AND THIS

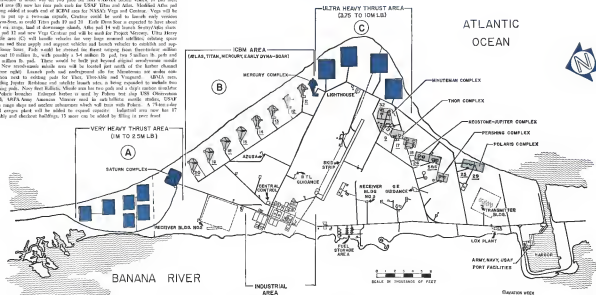
TWO BRISTOL SIKESLEY HATFORD diesel power the British Railways diesel hydraulic locomotives—develop a total of 2,700 hp. A huge number of Maybach diesel engines have been ordered by British Railways since

THE BRISTOL SIDDELEY GAMMA turbo engine powers the Saunders Roe Black Knight Britain's highly successful space research vehicle. The Gamma has a dry weight of 700 lb., weighs Black Knight 500 cubic into space

THE BRISTOL SIKESLEY MARINE PROTEUS powers the world's largest naval vessel, the "Hibernia" class Royal Navy patrol boats. These Proteus Sikesley a total of 11,200 hp—give these boats a speed of over 30 knots

Airline Work area's conception shows how Air Force Missile Test Center launching area is expected to grow to handle advanced space systems and booster engine thrusts ranging up to 100,000 lb. Dark blue squares show future launch pads, light blue circle areas, pads existing or under construction. North arrow (N) will be Very Heavy Vehicle area, with six or seven pads for launch booster thrusts from one to 2.5-million lb. for orbital versions of Dyna-Soar, large military satellites, other space vehicle test systems. Construction is under way on two pads for ARPA/AFM Saturn vehicle in this area. ICBM area (B) now has four pads each for USAF Titan and Atlas. Modified Atlas pad is being added at south end of ICBM area for NASA Vega and Centaur. Vega will be able to put up a two-stage satellite. Centaur could be used to launch early versions of Dyna-Soar, or could Titan pads 19 and 20. Early Dyna-Soar is expected to have about 5,000 sq. in. wings, land at downrange islands. Atlas pad 14 will launch Sentry/Atlas class. Atlas pad 12 and new Vega Centaur pad will be used for Project Mercury. Ultra Heavy Vehicle area (C) will handle vehicles for very large manned satellites, orbiting space stations and their supply and support vehicles and launch vehicles to establish and support lunar bases. Early could be created for thrust ranging from five-million to 10 million lb., with possibly a 5-4 million lb. pad, two 5 million lb. pads and a 10 million lb. pad. These would be built just beyond original aerodynamic model test New aerodynamic model area will be located just north of the further channel (center right). Launch pads and underground site for Minuteman are under construction next to existing pads for Thor, Vela-Atlas and Vanguard. ARPA area, including Jupiter, Redstone and satellite launch area, is being expanded to include two existing pads. Navy fleet Ballistic Missile area has two pads and a ship's reactor simulator for Polaris launches. Enlarged harbor is used by Polaris test ship USS Observation Island, ARPA/Army American Monitor used to orbit ballistic missile studies, USAF ocean range ships and satellite instruments which will train with Polaris. A 14-acre area beyond center plant will be added for support equipment. Industrial area now has 17 assembly and checkout buildings, 15 more can be added by filling in river front.

Cape Canaveral Growth Potential



has considered the center since 1954 and through its period of great expansion, would realize that "supporting facilities such as are provided by our range and its infrastructure are too often taken for granted," with the result that "for the past five years we have been driven into a frantic race with major performance in our job to

provide maintenance of continuous performance. I see a problem forming which becomes more open close cooperation of our future management requirements with the state of the art in data acquisition," Yates said. "For example, in electronic tracking, we are being asked to improve our accuracy not by a factor of two or three

but by one order of magnitude to accommodate a second generation missile soon to be tested. "Expansion in space will bring about three new family of requirements which, a few years hence, will probably require today's space tracking equipment to the class of precision first attempts."

The handling from wartime development was achieved in meeting the requirements of the ICBM program. "We are now at the bottom of the barrel, so to speak, in instrumentation development. We would like to initiate a major development on a new tracking system during this fiscal year (1959), however, funding limitations have dis-

posed that this must be deferred. "We must get this equipment developed and installed on the range if we are to meet presently known requirements. It is not difficult to foresee automatic systems of the future with more demanding requirements than can be met even with this new equipment." Yates said the job cannot be done

without that this must be deferred. "We must get this equipment developed and installed on the range if we are to meet presently known requirements. It is not difficult to foresee automatic systems of the future with more demanding requirements than can be met even with this new equipment." Yates said the job cannot be done



MISSILE velocity and position data obtained by Conner Acme system allows prediction of impact point. Note Atlas launch at rear.



TRI-HILICAL telemetry antenna, mounted ship on Air Force Missile Test Center's large Tracking Laboratory, is one of many data gather devices operated by Radio Corp. of America.

retransmission system to meet the test requirements of the new vehicle in addition to the prototype.

Then the bottleneck in retransmission. For example, several major instrumentation systems and to support the ballistic missile operations required an average of about four years for development. If you add to this the amount of time required for the budget cycle, plus the time required to check out and verify the system after it is installed, the average time from inception of the need to an operational use of a complex instrumentation system can be as great as five to six years.

Yates suggested the following as some partial answers to the long-time problem.

- Continued cooperation by the instrumentation developer of what funds, people, are developing. This is difficult because "system construction do not have a clear outline of test needs until the actual test stage is near. Consequently, this, an scientist is asking the advance information we need is provided with our development plan."

- Prompt development of new instrumentation to proceed "not on the basis of known missile requirements, which to advance the state of the art but against the trend of technical requirements in forecast by top missile and astronautics people." The center's parent Air Research and Development Command has applied research programs with these goals, but instrumentation projects must compete with more glamorous and often developments for their funds.

Yates said a "well-rounded, flexible retransmission development plan, adequately funded and aggressively pursued, would allow tracking in even



ATLAS radio command control guidance system developed by General Electric will be used in future attempts to place Atlas in orbit.



EXPERIMENTAL Inland telemetry antenna (above) is mounted atop a building at Patrick AFB headquarters for the test center. Below is one of a dozen ocean range tracks used for tracking and telemetry along the 1,000 mi range. Note instrumentation downer ship is docked at Trinidad.



AUTOMATIC TLM-35 high-gate tracking station located at Cape Canaveral around downrange clouds are used for the missile and satellite tracking.

WHEN GUIDANCE COUNTS...

Daystrom Pacific has 120 gyro answers

For every guidance system requiring a rugged, reliable, field-proven gyroscope, Daystrom Pacific has 120 answers. They are the 120 Daystrom gyro design variations, available for modification that may meet your exact needs. Industry- and military-approved, Daystrom gyros have met customers' requirements, including the toughest environmental conditions, in more than 30,000 installations with consistent success.

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potentiometers / gyro instruments / airborne systems

Population Growth— Beavard County

(Section of Air Force Missile Test Center)

Year	Population
1940	18,142
1950	23,423
1955	46,655
June 1957	72,000
1958	81,820
1959	104,889
1960	121,890
1961	144,444
1962	154,000
1963	162,300

Note: Due to lack of complete census figures from 1958 through 1959 are estimates, although available figures indicate significant population increases. Figures beyond 1959 are, of course, projections.

along the gap between need and existing hardware. He added, however, that this gap is "now widening day by day."

Certainly some handiwork is necessary in the state of the art if we are to satisfy the data acquisition needs for future vehicles.

Among the most recent instruments has addition is the improved Ayres Mark II missile impact predictor (AW July 27, p. 41) with a 1,000-mi range that can be extended to longer distances with the addition of narrow band and correlation circuits. This will be significant only in 1960.

Other advancements that the center and its users operate hope to obtain in the next two to three years include:

- Shift to higher telemetry frequencies. Next year the 316.214 mc band will become 225.102, with the lower band remaining available as a new protective

Personnel Growth

Air Force Missile Test Center

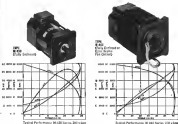
Year	Personnel
Existing, 1958	2,419
1959	2,112
1960	4,420
1961	12,886
1962	16,426
1963	17,465
May 31, 1959	18,417*
Estimated future growth:	
Fiscal 1959	25,000
1960, 1961, 1962	25-32,000

* Includes 16,000 civilians, of whom 10,710 are contractor personnel, 2,014 military. Of the military, 1,440 are assigned to the center, 5,128 in forward units such as 4 and 6 and 47 in contractor.

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M-430, 440 Series
typify capabilities
in meeting special
design requirements

These 400-cycle, high-speed, 115/230 v ac motors were developed especially as components of Airborne large special air arms for aircraft/marine applications. Because of their useful performance characteristics, we now offer them separately—both as additions to our line of general motors and as examples of Airborne capabilities in their particular class of application.



M-430 Series, 3-in. frame

Independent duty ratings in 1.0 hp, 200-watt, 115/230-volt ratings in 1.0 hp. Available with magnetic brake which will stop motors in 22 ms. from no load speed not greater than 3000 rpm. Available with Model shown as a 7.5-hp, 115/230-volt motor rated 1.0 hp at 14,000 rpm with a duty cycle of 0.5 min. on, 0 min. off.

M-440 Series, 4-in. frame

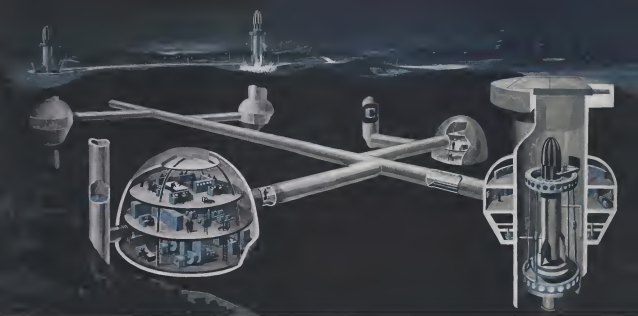
Independent duty ratings in 1.0 hp, 200-watt, 115/230-volt ratings in 1.0 hp. Available with magnetic brake which will stop motors in 22 ms. from no load speed not greater than 3000 rpm. Available with Model shown as a 7.5-hp, 115/230-volt motor rated 1.0 hp at 14,000 rpm with a duty cycle of 0.5 min. on, 0 min. off.

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Complete electrical distribution systems for USAF's first two Titan hardened missile complexes at Lowry AFB, Colorado, will be 100% Westinghouse.

Whether above ground or below, soft or hardened, defense installations require a great variety of equipment which must operate without fail as individual units and as elements of interrelated systems. As a

supplier to the government and to general, electrical and mechanical contractors, Westinghouse provides system-coordinated assemblages of hardened or shock-proof apparatus which assure the most reliable and economical installations.

Take advantage of this Westinghouse experience, product range and application coordination. Contact your Westinghouse sales engineer, or write: Westinghouse Electric Corporation, P. O. Box 366, 2 Gateway Center, Pittsburgh 30, Pennsylvania.

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Westinghouse distribution system equipment includes: Circuit Breakers • Switchgear • Power Centers • Motor Control Centers • Panelboards • Reduced Voltage Starters • Transformers • Alarm Panels • Relays • Safety Switches • Pushbuttons

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 USAF Corps of Engineers • Defense District Office—Orlando Office
 Martin Marietta & Associates • General Dynamics
 Fairbanks & Morse • Lockheed Martin
 Lockheed Martin, Inc.

Below is a description of a specially hardened electrical site showing in blue some of the equipment which Westinghouse can supply. Copies of this brochure suitable for training are available upon request on your introduction.

YOU CAN BE SURE... IF IT'S
Westinghouse



Watch "Westinghouse Sells Bell Bell Jones Bell" CBS TV Pilgrimage



NEW CONCEPT: The S-60, prototype for future Sikorsky flying cranes, now is demonstrating in flight, sacrificing new ways to handle both military and commercial materials and construction bottlenecks.

NEW POWER: Sikorsky flying cranes will utilize high-powered gas turbine engines, affording every advantage with its favorable power-weight ratio.

GREATER CAPACITY: The prototype S-60 lifts 5 tons with ease, with its two 2100 hp, Pratt & Whitney Aircraft JT-3D-40 piston engines. Turbine-powered models in design will carry from 10 to 60 tons of payload.

ALL-PURPOSE DESIGN: Cargo lifting is simplified by design that straddles the load. Spreader bars will speed movement of personnel and of communications, maintenance, and medical equipment, and will remove many other particular needs.

SIKORSKY AIRCRAFT, Stratford, Connecticut

Sikorsky S-60
—giant new
flying crane



Sign at entrance to Patrick AFB, USAF Missile Test Center headquarters, was recently changed to reflect its expanding space role.

base. Some time prior to 1970, all telemetry operations in the 216-360 mc band will shift to ultra high frequency bands to where congestion is lower frequencies. Although some UHF components are not yet fully developed, use of UHF frequencies are expected to result in less than attenuation of signals and less noise from the stars. This also should leave development and use of new types of modulation such as pulse code modulation and utilization of higher subcarriers in the present PCM/FM system.

• **New telemetry receiving system:** In the 2,100-2,300 mc band for Grand Bahama Island and Anguilla Island tracking stations and pulse code modulation telemetry ground stations for Grand Bahama, Anguilla, San Salvador and Antigua. The PCM system will offer the advantages of increased accuracy, high channel capabilities and communications and compatibility.

• **Improved tracking system:** for positive tracking of missiles when on-entry shock waves break out into space. Two systems would be installed on Antigua and one on Anguilla. This would be used to enter tracking nets and be capable of self-tracking when only one collection. Problems on the infrared track would provide the angular data

for repositioning the radar antenna.

• **Target acquisition and display system:** handling real time data for the extended range, would be installed on Grand Bahama, San Salvador, Anguilla and Antigua. This system is revised and oriented not only for present requirements but also would meet requirements for missile and space systems over the next 10-15 year period without requiring major modifications.

• **Stable, electromagnetic radiation monitoring station:** to support special programs and spaceflight progress. Engineers would be used, three at Grand Bahama, three at Antigua and one each at San Salvador and Anguilla.

Grand Bahama Station

Grand Bahama, the left island station in the chain, is some 150 mi. from the Cape. It was first used on June 30, 1951, to monitor a Minuteman flight, and a Minuteman first landed there nine days later. Since it is one of three or four primary stations, a lot of its services and equipment allow the function of the downrange bases.

• **Data acquisition for midrange and terminal trajectory intercepts,** using cubic telemetry links.

• **Midrange and terminal radar coverage** for terminal and range safety pur-

poses using two tracking radars.

• **Electronic and position data acquisition** in support of ballistic missile testing using DDMAP and EXTRACTOR systems.

• **Air surveillance radar** for range clear area, using AN/TTS-3.

• **Radio distance control** (two fixed AN/FBW-2 transmitters) and high power distance control (10 kw. dual, AS) power amplifiers for range safety and control.

• **XIN-2 (AN/TTS-16) radar coverage.**

• **Optical tracking coverage** of ballistic missiles (three BC-4 ballistic camera facilities).

• **Frequency analysis and control** for range safety and control.

• **Acoustic ranging** for measurement of the nose-heat.

• **Surface and upper air weather data.**

• **Single point control** for range safety and control.

In the future, Grand Bahama also will provide additional support facilities including, microwave tracking of missiles and theodolite tracking of satellites.

This is the first of two articles detailing the technological advances and needs of the Air Force Missile Test Center in past growth and future potential.

All these jet aircraft use General

Electric fuel flowmeter systems



CONVAIR 580



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NORTHROP F-5H



BOEING B-47



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REASON: operational savings
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For the full story on mass fuel flowmeter systems, write for bulletin GEA-6828, General Electric Company, Aircraft Instrument Product Section, 40 Federal Street, West Lynn, Massachusetts.

INSTRUMENT DEPARTMENT

GENERAL  ELECTRIC



AVIATION WEEK editor Robert E. Shachtel flew to Europe and return as a crew member of a MATS Douglas C-133A.

C-133A Overcoming Operating Problems

By Robert E. Shachtel

Dover AFB, Del.—Navy's Air Transport Service's Douglas C-133A Hercules transport aircraft is fast approaching an unblemished operating hour despite "growing pains" tied to its quite support and spare, modifications, and problems with engine and propeller components. The C-133 has landed as much as an 85,000-lb payload to its cargo, and has earned a record 317,000 ft of cargo to an altitude of 10,000 ft.

For a first-hand check on C-133 operations and on spare performance, this Aviation Week editor traveled to Eastern Transport Air Force's Dover AFB, from which he flew to Europe and back as a crew member of the Capricorn, which was first evaluated in this magazine last year (AW May 12, 1958, p. 70). The airplane, which normally flies at a maximum gross weight of 275,000 lb, can carry up to 117,720 lb of fuel and has a maximum payload of 117,880

lb. Its average overseas mission is to carry a 60,000-lb payload. The C-133A is powered by four Pratt & Whitney T34-P-TW turboprop engines at 6,800 rmp each. Three-bladed propellers, of 18-ft diameter, are full-fiber-reinforced epoxy resin. The C-133 can carry one engine at maximum load—with full tanks it can load some 30,000 lb of cargo. Regulating with production aircraft No. 55, Shachtel down still add three feet of usable space, for handling of Titan



PALLETS are pushed normally into C-133A (left) by hooking a conveyor-mounted derrick roller to the forward cargo door. Lightweight roller conveyor are being installed in C-133A flow in background at right. Nylon straps form a cage which contains palletized cargo.



without assembly. (Titan, 54 ft, comes next, is generally shipped in two parts, the aft section being loaded first.) Also, which is now a tight space, and steadily raised to one C-133 and over C-133, also will be into the new machine in a time table operation than at present.

Capable of handling 95% of the implements of war, the Capricorn can carry a 20-ton cargo, from a medium tank, 320-ton gun on the M1 record, Sikorsky HO-4S helicopter and T-41 B1 gun 76-ton tank.

The C-133's main structure is greatly strengthened with the completion of the Aft (tail and nose), due to this new supply for stress (structural support). Aircraft from Dover have flown to the Middle East, Africa and Europe (to the Pacific, too). From Dover AFB, Calif., Capricornes currently fly to Honolulu, Wake Island, Japan and Guam. Both have military flights throughout the United States, particularly from inside re-evaluating sites to test cargo.

MATS has set to address its eight main education role for the C-133. (Most of the aircraft are assigned to the 24th Air Transport Squadron of INADAF's Dover AFB and 10 to the 44th Air Transport Squadron of Western Transport Air Force's (WTS) MATS base AFB.)

Dover expects to have 16 aircraft assigned by January, 1960. There also expects to reach this figure at this date, with one-month deliveries through December. Dover arrived its first Capricorn on Aug. 28, 1957. Early record its first regular Oct. 15, 1958, and made its first flight in the Pacific over the following January.

Dover's C-133 Operations

Highlights of Dover AFB's C-133 operations under the 1807th Air Transport Wing now commanded by Brig Gen. Robert J. Coates, include the following:

- **Overseas arrival.** On Aug. 10, 1958, a Capricorn arrived at Dover and the heaviest load arrived to date 82,900 lb of cargo via Hawaii. New Zealand, to Laos, Korea, to China, to France. A Dover-based C-133 made the first flight over the Pacific at October, 1958.
- **Altitude-perform record.** On Dec. 16, 1958, a C-133 carried 117,000 lb to 10,000 ft, breaking a world record set by the Soviet Tu-164 in 1957. Aircraft off the ground also a roll of 4,500 ft, steadily gained 278,500 lb. Weight on landing was 261,120 lb. Actual payload of 117,900 lb was gained from aircraft carrying weight of 116,900 lb.
- **Domestic arrival.** With one refueling stop at Carroll AFB, Tex., a C-133



ATLAS ICBM upper section is loaded into a C-133. The Capricorn usually aircraft can be loaded in one unit into a C-133, but is usually carried in one C-133 and one C-133A.



ARMY TANK is unloaded from a C-133A. The Capricorn is capable of handling 95% of all war material items. The Capricorn transport has loaded as much as an 85,000-lb payload to Europe, and has earned a record 317,000 ft of cargo to an altitude of 10,000 ft.

CASE HISTORIES



In many bearings, surface diameters and surface finishes must be held to within tolerances of one millionth of an inch.



Computer-assisted diameters in one-millionth of an inch. One of many close-up photographs mounted in the New Departure Instrumentation Ball Bearing Laboratory.

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CUSTOMER PROBLEM

Missile guidance system manufacturers require a dependable source for super-precision instrument ball bearings. When used in open rate and gimbal applications, for example, these ball bearings help restrict vitally important drift, through extremely close tolerances and high precision uniformity.

SOLUTION

New Departure research, development and production facilities were applied to solving the vital problem. Visual evidence of New Departure's success is the bright path of precision written across the skies by Sperry.

Altitude and other guidance systems used in many of the most advanced missiles and space craft. In the case of Sperry's gyroscopic guidance system, for example, New Departure instrument ball bearings are credited with a remarkable 1200% gain in gyro accuracy. Proof enough that New Departure has the know-how and facilities to solve tomorrow's instrument/missile ball bearing design problems in missile and space exploration.

What's more, these New Departure facilities are available for your design development right now! Call or write Department G-8.

NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

ENGINEERING HALLS 2 AND 3 BLDG.

on Oct. 28, 1975, earned 305,513 lb of cargo from Long Beach, Calif., to Dover AFB. Total load time was 9 hr 10 min.

• **Support load.** During the last three months of 1975, C-119s from Dover AFB airlifted components and support equipment of a fleet exercise in Europe. KC-130s carried mock shells. Cargo units carried non-combatants, loaded oxygen tanks and morale stickers. Totals ran about 625 in long, rough about 35,000 lb each and ran to be loaded on a C-119 in two hours (average about 75 in, length for other cargo).

• **Loading.** General cargo can be loaded into the C-119 in 15-20 min and a full load in 1 1/2 hr. Heaviest loading is currently utilized, in which cargo is placed on a floor-to-ceiling web plywood pallet (at least 40 lb capacity) and loaded on flatbed rails (low bed 40 ft trailer which holds one pallet and a tied down with one).

At Dover 319,000 lb has been loaded on C-119s in one time. For that, Martin Titan has been loaded, via web in a total of 70 min (14 min for second stage, 25 min for first stage). Its counterpart, the first Titan took 16 1/2 to load. So far, cargo complete value weighing not yet broken versus cargo weight approximately 2,375 lb, can load and secure about 70,000 lb of cargo in 45 min.

• **Crew capability.** MATS crew is as capable as well trained, and the 19th AFS, though the C-119s at Dover, ranged on Apr. 30 about 1,550 total flying hours for 50 qualified and qualified pilots including base and administrative, flight instructor, aircraft maintenance and first and second pilot, attached for training. Average base for 12 aircraft (maximums ranged) and attached was a high 7,171 hr. C-119 second pilots are all hand-picked C-124 first pilots. Normal crew has averaged 16 members: three pilots, three cabin crewmen, two engineers, two load masters. In addition to standard and modern procedures including joint mission, one first flight checks per year, two local and two time.

Two hours per month are required in aircraft or simulator and, for a three-month period, eight environment test down (in simulator) and eight flight loadings.

T34 Tanker-pup

The F14 Phantom also has its problems, says, ranging from "growing pains" and developmental troubles to "pilot stress." In one operation of "pilot stress" in Arizona, Wren "Too much is expected of this airplane, which can handle as much as the C-134." Most pilots agree.

Chlorine gas

Chlorine gas is used in the

gas, MATS would pack to start as but come at not less than 38,000 ft but is limited to start at an average of 11,000 ft and 3,000 ft, step climb. Reason: insufficient power above 10,000 ft, at maximum gross weight. Fuel reserve, during an average flight, average 25 min. Fuel reserve, during operation, after fuel, the C-119s burned to initial climb altitude of 14,000 ft. Heavy fuel consumption at low altitudes reflects long-range transport operation. Along these lines, Federal Aviation Agency traffic control centers for some criticism for prolonged low-level holding procedures, which are bad concerning the aircraft's weight loss. When a heavy load is held after 14,000 ft, at 4,000 ft for 15 min. With two times, initial holding and climb to 38,000 ft—total of 55 min—fuel consumed was 11,500 lb. Can capacity at 38,000 ft, 1 hr 30 min, after takeoff, including one fuel tank, was 8,910 lb. At 14,000 ft, initial climb altitude will increase with installation of Pratt & Whitney 154-2, 900 (P1136) engines of 7,800 cfm in the "3" engine. A preliminary, since aircraft gross weight is expected to increase from 275,000 lb to 285,000 lb. Fueling in some quarters is that the airplane cannot as engine in the "3" 10,000 cfm, but 10,000 cfm.

Engine overhaul

154 turbines now

DAY-GLO®
AVIATION SAFETY PAINT

"SAVED MY LIFE"

Boys Corporation President and Pilot Peter Flagg

Peter Flagg is president of the G. A. Flagg Company of Memphis, Connecticut, the largest specialized paint contractor in the Eastern U.S. The company sponsors a two-ounce, three-passenger Aero Commander and employs a full-time pilot.

"We were flying along at 8,500 feet," says Mr. Flagg, "when I suddenly noticed a jet bearing straight away not 200 feet from our left wing. We saw no other passengers and they could see the expression on the pilot's face. I am convinced that because my plane was liberally painted with Day-Glo, the jet pilot had time to take evasive action. I feel that Day-Glo saved my life."

This is just one of hundreds of experiences reported on what a gallon or two of Day-Glo Aviation Paint has meant to pilots and control tower operators, too. These provable case histories demonstrate the protection afforded by a paint that is four times more visible than ordinary paint, particularly under poor visibility conditions.

The U.S. Air Force evaluation proved even more dramatic. After a year in which they suffered nine "see-and-be-see"-mid-air, the Air Winging Command decided to paint some 1,600 planes. These aircraft were now with Day-Glo paint and "see-and-be-see"-mid-air were dropped to zero on the five-year record.

Contact Day-Glo Aviation Paint with the Finberg® clear overcoat latex and brush, according to Flagg: "Even though my plane has been hangared very little since it was painted last summer, the paint job still looks like new."

Don't accept substituted inerts on genuine Finberg® Day-Glo. Write today for name of nearest distributor.

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As a starter, we've shown a few of the many proved applications of the Fenwal Continuous Fire and Over-Heat Detector. But you know your particular requirements best. And you'll describe this advanced protection system . . . and you'll see the results follow!

The simple, lightweight sensing tubes string like a clothesline . . . slip easily into the tightest spots on a plane or missile. They stay in place, no moving parts control unit. And it's a discrete, non-arranging system . . . every tube a trouble-shooter!

Separate lengths of tubing, each responsive to a different temperature, can operate independently to give control logic in an engine nacelle, near a bleed air duct, in a wheel well, in a "solid panel" cargo compartment, or whenever temperature hazards exist. And its low impedance permits against "nocturnal alarm!"

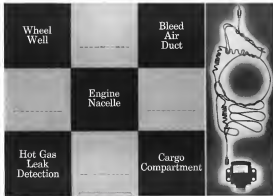
Get complete coverage with today's smaller airborne fire and over-heat protection. Talk your requirements over with a Fenwal Sales Engineer, Write Fenwal Incorporated, 332 Pleasant Street, Ashland, Mass.

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Where could you use the

versatile Fenwal Continuous Fire and Over-Heat Detector?

Boeing "Starliner" sensing tubing and separate amplifier of Fenwal Continuous Fire and Over-Heat Detector provide four multi-point protection.



C-133A Specifications

Maximum island weight	28,200 lb.
Design weight	275,000 lb.
Design area (incl. 12 ft. long bleed duct)	315,000 sq. ft.
Maximum landing weight (at 4 ft/s)	281,000 lb.
Normal landing weight (0.5 ft/s)	265,000 lb.
Operating weight	126,000 lb.
Maximum payload*	117,000 lb.
Wing span	179 ft. 8 in.
Length	157 ft. 6 in.
Height	45 ft. 8 in.
Stabilizer span	66 ft.
Cargo compartment	
Length	97 ft. 4 in.
Height	12 ft.
Width	12 ft.
Volume	11,215 cu. ft.
Cargo space length	37 ft. 5 in.
Area cargo deck	32 ft. 5 in. by 12 ft.
Side cargo door	4 ft. 10 in. by 6 ft. 4 in.
W/O's (Four Point & Whetstone, T34F)	
Propellers	Curtis Wright electric, three-bladed, 31 ft. diameter, full feathering.

*Normal operating weight must be less than 2,000 lb. in order to carry 317,000 lb.

have 600 lb. overhead tanks, which are expected to increase to 1,000 lb. The unit itself was subject to frequent and persistent failure. The problem was particularly serious at Denver, where 22 engines overhauled at San Antonio Air Materiel Area, of which 11 failed at an average of 35 hr. Throat leaving failure, involved secondary door and consequent air contamination were involved.

• **Leak restrictions.** The C-133A has been restricted from using forecasting moisture using which are expected to exist for periods in excess of one hour transverse. Recent engine fluctuations ultra propellers system is subjected to wing. Occasional burning of the fuel control system was attributed to freezing, water entrapment within burner permeation, following.

• **Spares and support.** En route support and spare parts problem gradually is being alleviated, but it is still in the "naïveté" stage and a delay. Parts are being coordinated. Spare propellers and components constitute a new spot particularly because of difficulties with governors, drifting from crank settings, oil leaks and shoring of control shafts. Propeller inspection level at 2,200 hr. in early test program was reduced at 1,100 hr.

• **Auxiliary gas turbine units.** Units provide hydraulic and electrical power, provide pressurization and air conditioning. Time between overhaul is 300 hr. for the 85-2 model, 400 hr. for the

85-3, expected to increase to 1,000 hr. The unit itself was subject to frequent and persistent failure.

Current improvement program for the C-133 covers 30 aircraft, with the second contract to increase through 1978. Included are 15 C-133Bs, the first of which will go into test this December. Denver AFH is prepared to receive all of these 30 models.

Denver now has 12 C-133As "tagged" (others having been returned to Douglas at Lang Beach for major modifications).

Aircraft modifications must exceed 15% for training, 35% for scheduled operations (cargo only) and 50% for special missions (medical, medical components and support equipment, the former termed "Go-Way Operations").

Cargo Operations

Cargo operations usually are scheduled two or three months in advance. Special missions embrace a diversity of needs.

Chartered cargo is handled by MATS at a taxable rate. All donated Special missions are charged at no load rate.

In comparison, the nearby Douglas C-124 Globemaster, of which Denver has 74, has a sophisticated bankroll of 60% scheduled cargo, 15% training and 25% special missions. Both the C-133 and C-124 fly 61% of their total missions over water. The special mission, the C-133 flies 75% over water, 25% domestic.

The Capomare is prepared to fly about 5 ft. per day, approximately

C-133A Performance

(at 275,000 lb. unless otherwise specified)

Service ceiling	15,000 ft.
Emergency ceiling (MFR on)	
Best engine	11,100 ft.
Climax altitude	15,000 ft.
Maximum control speed	105 kt.
Maximum with two engines out	136 kt.
Minimum speed (30,000 ft.)	238 kt. TAS
Normal operating speed	246 kt. TAS
Never exceed speed (lb.)	
15,000 ft.	275 kt. 145
Critical field length	5,490 ft.
Takoff field length	4,500 ft.
Landing ground (ft.)	2,515 ft.
Rate of climb (initial, sea level)	1,300 ft./min.
Three-engine rate of climb (initial, sea level)	400 ft./min.
Fuel capacity	117,720 lb.
Range, maximum gross (full tanks, 47,000 lb. cargo (no reserves))	3,575 mi., avg.

your avionic TESTING PROBLEMS SOLVED!



Radome Foresight Error

The C-133A has been found to have a foresight error in its radome. The error was caused by a misalignment of the radome. The error was caused by a misalignment of the radome. The error was caused by a misalignment of the radome.



Flight and Altitude Simulation

The C-133A has been found to have a flight and altitude simulation error. The error was caused by a misalignment of the radome. The error was caused by a misalignment of the radome. The error was caused by a misalignment of the radome.



Quality Control and Ground Support

The C-133A has been found to have a quality control and ground support error. The error was caused by a misalignment of the radome. The error was caused by a misalignment of the radome. The error was caused by a misalignment of the radome.



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Marine HRS Modified for Spraying

Sikorsky HRS helicopter has been modified at Cherry Point, N. C., Marine Corps Air Station for insect spray runs. Aircraft carries two 55-gal tanks of insecticide decont to spray insects on each side. Modified HRS was test flown at Cherry Point and will undergo service evaluation tests at Eglin AFB, Fla. Modification was made under a program of the Bureau of Aeronautics and Bureau of Medicine and Surgery.

twice the thing now done. The C-124, for comparison, averages about 5 hr. per day, and is programmed for 5 hr.

Month. C-119's utilization is high, limited by the following EASTAF operations data for Dover AFB during March of this year:

• Total time: Flying hours numbered 690, of which 546 were for training, 121 for transport, 12 for test hops, etc.

• Engine changes: Total was 15, of which 12 were for failure and three for high time. Engine life at time of change average, 258 hrs. failure at 146 hrs, high time at 546 hr.

• Maintenance: Mechanics totaled 61, 371, in direct labor was 30,206 hr. Direct maintenance flying hours were 51.8. Maintenance inspections were as follows: Preflight 49 inspections @ 4 hr./inspct., 43 maintenance/inspct. Postflight 12 inspections @ 20 hr./inspct., 153 maintenance/inspct. Periodic 50 inspections @ 215 hr./inspct., 1,575 maintenance/inspct.

• Payload: Average during the month was 56,200 lb. (21.5 tons).

• Loading: Mechanics per aircraft per day 24.6. Average time to load one aircraft was 3.9 hr. Mechanics expended per ton loaded average 7.6, compared with 1.4 for a C-119. By comparison, the average C-124 payload at Moody was 30,500 lb., 20.9 maintenance were expended per aircraft loaded and average loading time was 7.6 hr. In the first half one C-119 was loaded 1.43 C-124 could have been loaded; but 11,000 fewer pounds would have been loaded on the C-124. Direct operating cost for the C-119 averaged about 7¢ per ton mile. This figure is for actual per load flight and does not include training and taxing flight hours.

• Cost per hour: Dover's cost per fly-

ing hour by type aircraft, based on actual operations for the first three quarters of Fiscal 1970, was \$250.32 for the C-124C and \$407.18 for the C-119A. For March, the cost was \$296.66 for the C-124C and \$410.18 for the C-119.

The Globemaster's jump over the first three quarters was due, perhaps, to economies in direct maintenance of

aircraft and engines. This, some believe, was due to the C-119's greater age; the main factors were reduced engine and depot maintenance of engines.

Overseas Routing

C-119's out of Dover are usually routed to Europe via Lajes, Azores, 2,275 mi.; out via from the Delaware base, at via Haveron, Newfoundland, 361 mi.; via from Dover. Aircraft operate to two main areas: Caribbean area, France and Netherland, England.

The distance from Lajes to Gablestone is 1,381 mi.; out from Lajes to Middlefield is 1,495 mi.; out from France Haveron, the distances are 1,472 mi. and 1,255 mi. out, respectively. Distance direct, Dover to Gablestone, is 1,430 mi.; out, to Middlefield direct is 1,410 mi.

Pacific routing out of Travis AFB, with flights to various bases, covers Tokyo to Hickam, 2,142; Hickam to Wake, 2,078; Wake to Eniwetok (via Marcus Island), 1,775; Eniwetok to Midway, 1,180; Midway to Travis, 1,875; Midway to Hickam, 1,160.

Basic Capability

Cargo loaded through Dover, at normal and maximum rates between 10-14 million lb. a month. The base has the capability of handling and processing 20 million lb. without coming into



Bell HUL-2 Features Turboshaft Engine

Bell HUL-2 turbine-powered helicopter model is set over to show positioning of the Allison T55-A-8 turboshaft engine which produces 250 hp. Navy has ordered two months for production (AW July 6, p. 31). Helicopter is an advanced version of Bell's HUL-1 and company says it will have increased hovering ceiling (to about 15,000 ft.), higher payload and better speed. Chalk rate will be up to 1,100 ft./min., maximum speed will be more than 120 mph, and climb will carry 1,800 ft. payload in addition to the pilot for a range of more than 300 mi. Engine drives a main rotor.

COMMUNICATIONS...

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warfare capacity. Current storage level can hold 1.5 million ft. of cargo without overflow. About 250,000, 300,000 lb. cargo is common on-board per day, about one-half this amount is released daily.

Cargo Handling

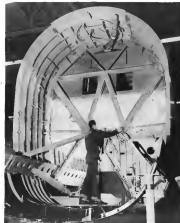
C-115 cargo is loaded on pallets in the tunnel, which is 300 ft. wide, 40 ft. long, and has a 13 ft. wide covered loading dock. Eight ramps provide access to 91,654 sq ft. of port area, which is isolated to enable out of 95-149 sq ft. to be lost for down and 44 ports. Cargo is moved from a pier equipped with roller conveyors to the aircraft. Pallets also are placed on flat bed trailers equipped with roller conveyors and driven to the aircraft.

The prototype Douglas version, developed at Dover for the C-115 and undergoing a six-month test, releases 7 ft. x 30 ft. rigid pallets to which

cargo is secured by means of metal straps forming a cage. Pallets are moved to the aircraft on lightweight roller conveyors situated to the aircraft floor. Side grade rails, removing the roller length of the cabin floor, guide the pallet and provide a source of rapid release.

Grade rails are restrained to the floor with integral stainless straps and incorporate pins which engage the pallets and provide restraint in all directions. Loaded pallets not exceeding 90 ft. total height may be loaded by the straight and level method. By loading conveyor-equipped flatbed trailers to the horizontal ramp, pallets can be pushed manually into the aircraft.

The C-115 ramp is restricted to 13,000 lb. weight and 10,000 ft. stored. The T-115 version is presently loaded in two stages. Refueling by comparison, moves in three individual stages. For the former, an electrically-



B-52G Bomb Bay Made of Forgings

Boring Airplane Co. Industries receives forward loading gear bolted in bomb bay section of B-52G jet bomber, Raytheon says 12 x 14 ft. and used in main almost entirely of forgings. Top assembly (W-shaped) is manufactured by H & H Machine Co.

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operated portable track is visible. The track can be plugged into aircraft outlets or tied to its internal power source of 280 v. The search body, 204 ft. of 7-in.-dia. steel cable capable of moving at about 300 ft. per min., is pulled at the rate of 1 ft. per min.

Cable from the search, hooked to the front section of the aircraft, is run out to 17 ft., which sits on its transmitter (track), and is hooked into two stages. Stage two, weighing more than 10,000 lb., is shorter than stage one, and is pulled into the Cargo-master first. Stage one, also weighing over 10,000 lb., takes up most of the aircraft and search cable lowering the front end of the transmitter and causing the back and during the landing operation.

Clearance area on stage one is critical, as a stick meter hanging from the cable top allows only 2 in. clearance from the top of the search, which can be decommissioned with but one switch. Personnel are stationed at critical areas in the search is pulled about. Should the search come within six feet of any part of the aircraft, a sharp blow to a police whistle is given as a signal to halt the search.

Two Martin Co. personnel will service the Titan during the entire flight, via four master batteries of 1,500 psi each, keeping it under constant pressure to prevent contamination inside the tank, which could cause its collapse.

Efficiency and effectiveness of well-coordinated MAJG crew was evident to Aerospace Week attendees who flew eastbound to Midland, via L-1011, via EASTAF C-111 and return from Charleston to Boston, via Air Force, via WESTAF Cargo-master.

Flight to England

The flight to England constituted a Co-Wing Mission, and also an upgrading to aircraft commander for Capt. Richard Hawks, who was being elevated by 16574 Air Transport Group chief pilot Maj. Henry Barbours. Other crew members included first pilot Lt. James Foster, flight instructor pilot Capt. Donald Bell, navigator Lt. William Packard, engine technicians, all master sergeants, Warren Ross, Donald Robish and Clifton McGee. Landing was at 5:30 p.m. at Farnborough, via Dover, via a runway of 12,111, surface temperature 28C, was made at gross weight of 274,950 lb. The aircraft was airborne after a roll of 5-230 ft. Initial rate of climb was 708 ft. per min. until the engine cleared and speed built up to 190 kt. The rate then increased to 1,300 ft. per min.

Flight to Ames was made on stage climb, held down initially by traffic control which held the C-111 in holding pattern at 4,000 ft. for 12 min. Then, about 10 min. after 10:00, at 37,000

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Model Shows New Komov Helicopter Configuration

Experts are showcasing a new Russian helicopter in a follow-on to the Mi-24 and Mi-26 developments. This model was displayed on an air lifting platform of a model of the multi-powered helicopter Lerma at the Soviet Exhibition of Science, Technology and Culture in New York (AW July 24, p. 117).

It, not average fuel consumption of 10,000 lb/hr.

The model, No. 56 2000, loaded at 14,000 lb. at 40 mm after takeoff, with 15,000 lb. fuel left in hand. There were no delays on route to Midland and no trouble arose. G-133 flight characteristics and controllability are good. The model has no boost system, only flying tube. Cruise was held to 260 ft. true altitude. This flight was entirely by hand. Helicopter Pioneer PB-15 solo pilot in still in test status.

Return Flight

Return was made on G-133 "Sport of Soviet Motor Network," No. 54 140, which had been on display at the Paris air show (AW June 29, p. 20), and which was extremely impressive during its low-level fly-by, grossing 170,000 ft. The WPSTAF explains, not at T-1000, AFB, at the airport of an show officials made two of its passes with engines out, first the two shroud, then the two post. Impressive, also, was the high-speed pass and climb-out initiated following takeoff and low-level fly-by across the field, with two propellers feathered on one side.

The WPSTAF crew, hand-picked for the Paris show, was commanded by Maj. Robert Torrie, assistant operations officer for T-1000 543 AFB. The crew included flight instructor (A/C) Capt. Robert McManis, first pilot; Maj. James Myers and Lt. William Solari, second pilot; Lt. Sidney Carter, navigator; Lt. Charles Greenlee, emergency tech; and Sgt. Kenneth Winters.

shroud, climb was at 1,100 ft. At 17,000 ft. the G-133 was ascending at 600 ft./min. and locked off at 15,000 ft. Cruise altitude was 1,100 ft., with 6.5 ft. cruise differential pressure.

From 14,000 ft., grossing 274,000 lb., outside air temperature, at field elevation of 180 ft. being 29C, climb to initial cruise altitude of 14,000 ft. was made in 20 min.

Reg. as the G-133 cockpit, the design might have confused the engine sitting parallel with pilot and copilot, rather than facing his panel aft of the cockpit and Russian the engine has no clock, outside air temperature gauge, an airspeed indicator for his oil column, neither has he engine status sounds or access to engine controls. He must check other panels to maintain his flight log.

The Russian use of engine instruments, on the main pilot's panel, the oil temperature and oil pressure gauges, are partially obscured by the lamp of the engine indicator, and can't be read properly by either pilot or instructor at their respective stations. Knowledge necessitate one of the three handling his own the pilot.

The new G-133 flight deck is comfy, the adjoining "hangar" is comfortable and relatively quiet, with two engine type seats and a four-place couch that looks out onto a bank. Pullman-style coffee buffet and better private but "TV-dinner" type meals, a far cry from the "hot lunch" days.



Escape Capsule Designed for Mach 2-3 Aircraft

Airside escape capsule was designed by Republic Aviation Corp. for escape from Mach 2-3 aircraft, and from manned satellites. Two ejection seats are located inside the capsule and a parachute facilitates recovery. The capsule can also be adapted to low-altitude and low-speed escape as an aircraft. Republic says. Sequence of operations, shown from left to right, takes less than two seconds.

One side view of submarine displaying John's Ballroom in military communications through the eyes.

GLOBAL COMMUNICATIONS—1816

The Battle of New Orleans

on January 8, 1815 was fought 18 days after the end of the War of 1812. The Treaty of Ghent was signed.

His war began the U.S. and Britain had been signed in Europe on December 24, 1814. The day the news reached America.

General Andrew Jackson with his army of 7,000 men, 200 guns and a few regulars, surrounded New Orleans.

People and war the American victory over the British. The British 1,000 men were captured and sent to St. Louis.

This was not the first of the large global battles covered up by the authors of Napoleon and the French Revolution.

The Battle of New Orleans



Now, the United States is leading the free nations in building a network of defense to maintain world peace in the face of today's aggressive ambitions. In this age of global communications our defense network requires instantaneous Electronic Communications. Within seconds, policy makers and commanders must have knowledge of events, must receive and give orders. Two-way command and data-link communication, instantly available, is essential for world-wide success in time of crisis.

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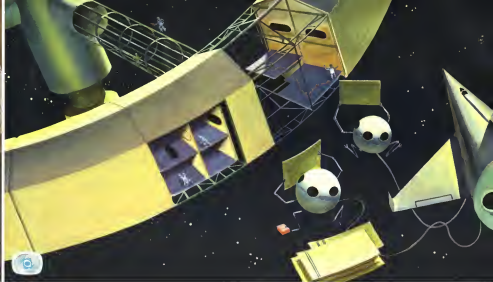
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DESIGNS AVAILABLE to engineers and architects in advanced communications systems from Defense Sector of United States of America. Electronic Communications, Inc., St. Petersburg, Florida.



The is Dr. R. E. Edstrom, Project Engineer. Here he examines a model of his Solar Radiometer, a multiple star tracking device which is expected to provide the accurate thrust of space vehicle velocities to accuracies of the order of

General
Mills



300 feet per second. The Radiometer is designed so that precise alignment of the star stations is not necessary. Its leverages could have a bearing on self-contained guidance systems used on future space vehicles.

assembling a space station . . . illustration from a book written for General Mills by Willy Ley.

General Mills is working **today** to help guide vehicles in outer space **tomorrow**

Development of a space vehicle guidance system which may one day be a factor in sending manned U.S. space stations into orbit around the earth is just one problem being attacked at the Mechanical Division of General Mills. In research, engineering and manufacturing, we are finding solutions to many problems that have application in the space age.

Our research activities cover broad areas in physics, chemistry, mechanics, electronics

and mathematics. Some of the studies representative of these activities are: ions in vacuum, deuterium sputtering, dust erosion, magnetic materials, stress measurements, surface friction and phenomena, trajectory data and infrared surveillance.

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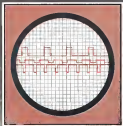
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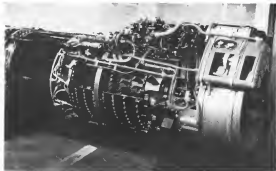


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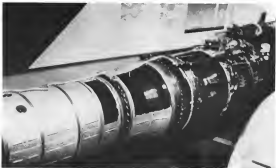
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Kuznetsov Turbojet Engine Powers Yak-25

Cutaway model of the Kuznetsov axial flow turbojet that powers the Yak-25 (flashlight) all-weather fighter is displayed in the Air Museum in Moscow. The turbojet is rated at 5,000 lb static thrust without afterburner and about 12,000 lb thrust with afterburner. Note simplified design that omits things of the Corvus jets and flow developments. Engine has a six stage compressor (shown above), variable compression chamber and a two-stage turbine. Short, single afterburner is shown below. Yak-25 is powered by two of these engines mounted under the wings.





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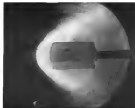
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TUNNEL project engineer J. A. Kunt adjusts a model about to be tested at 11,000 mph. in test section of the Chance Vought Aresch-Segerson unit. At right is a photo of the blast shape during a test at Mach 15. Inset shows an airfoil past the model produced by the power when engine throttle was left open. Chamber (right) behind model is reflection on window on opposite side of the 12-in. tunnel.



SQUARE on chamber (left) is heart of the Mach 20-capability wind tunnel. Capabilities behind technicians show up more than 1 million hp. of electricity for action into chamber of equipment on inside the chamber. Test last only 60-70,000th sec. At right, a 10-in. target engine provides a 1,400 gpm. flow to test engine and metal nose cones, heat before engine supply water for cooling.



Wind Tunnel Capable of Mach 20 Testing

Dallas-Chance Vought Aresch has extended its wind tunnel test capabilities into the Mach 20 area by adding a new hypersonic tunnel to its subsonic, transonic and supersonic tunnel complex.

Hypersonic tunnel now in operation supplements an older subsonic tunnel and the new transonic tunnel opened last test year (AWW Dec. 29, p. 17) which can handle velocities up to Mach 5. Company also has a target facility for testing space vehicle nose cones.

Compressed Air

In the hypersonic tunnel, 28 cu. in. of air are compressed in an arc chamber at pressures ranging from 500 to 2,000 psi., then are million kilometers

of electricity are released in the chamber, and temperature goes to 15,000° and pressure to 50,000 psi. A quartz-silica window disk is ruptured, and the pressure wave and compressed air rush through an eight-foot-long nozzle into the evacuated 12-in. test section and on down an 18-in. tube.

High Mach number flow around the model in the test section lasts only 0.040 sec., but it can be repeated with a photo-eye camera using a short time exposure. Polaroid and camera cameras mounted on overheads give pictures of traces on cathode ray tube displays the flowline test data.

In the test facility for nose cones, Chance Vought uses a 10-in. target engine to produce 1,500° test air and ana-

late steady effects. Metal or ceramic nose cones are mounted on a water-cooled shog and can be moved as close as three inches from the target engine exhaust tube.

Engine burns oxygen and JP-6, and a water jacket is used to cool the engine during test which can run as long as two hours.

Control Room

Test objects can be moved forward and away from the target engine to vary temperature, and angle of attack, and size can be varied. Operators monitor the test from a control room provided by shutterproof windows and through a closed circuit television system.



Reliable AIResearch fuel heater for the B-52



SPECIFICATIONS

Fuel Sub (WLF-F-32M, 2P-4)
Fuel temp. in -65°F
Fuel temp. out +32°F
Fuel flow 20,000 lb/hr

See Note
Air temp. in -60°F
Air flow 90 ft³/min
Control - Integral automatic
modulating thermocouple power
element type

AIResearch is now in quantity production of an extremely reliable engine-heated air fuel heater which prevents icing in the B-52 engine fuel system during flight. The unit allows a minimum of hot compressor bleed air to continuously modulate to keep fuel temperature above 32°F. Heating the fuel in flight overcomes the icing problem resulting from the presence of a limited quantity of water in the airplane fuel system regardless of the

source of such water contamination. Efficient design and development capability made it possible for AIResearch to build an efficient lightweight bleed air fuel heater system on an expedient schedule of seven months' time from initial order to production delivery. AIResearch has been the world's largest and most experienced manufacturer of aircraft heat transfer systems for 20 years. Outstanding design and production facilities, supported

by extensive laboratory and test equipment, enable AIResearch to quantity produce fuel heaters of any configuration in minimum time while maintaining rigid quality controls.

In addition to the B-52 fuel heater, AIResearch is also producing several other types of plate and fin exchangers as well as shell and tube oil/water heaters for both military and non-military aircraft applications. Your inquiries are invited.



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Aerial Mappers Use Gravity Meters

New York-Surveyable gravity contours mapping of California's Imperial Valley in series of airborne gravity tasks promises increased mapping accuracy for planning waste treatment and more effective means of mapping undisturbed areas of the earth. Aerial mapping system, precise to 10 milligals (gravity measurement unit) or better is adequate for geologic purposes.

Mapping Project

The mapping project accomplished with a Boeing B-17 was undertaken by Hughes Aircraft Systems, Inc. in conjunction with LACoRe and Kern Inc., a gravity meter company, and County Meter Exploration Co., a data reduction company.

The B-17 flights completed the final leg of a limited gravity meter test track, in November 1975, from an Air

Force Boeing KC-119 under sponsor ship of the Air Force, California Research Center, Bellfield, Calif.

Air Force interest in some gravity problems information stems out with those interest in remote topography, but also in preparing facilities of long range navigation facilities. Small errors in the location of Loran stations are amplified in fixing the location of its accurate as ship at long ranges. Corrections in related positions have been made in observation of satellites, but even this method is impractical for mapping large areas.

Aerial Gravity

Aerial gravity contour mapping is made possible by reference, not only to suitable gravity meters but to navigation equipment such as altimeters, autopilots and recording equipment which



Dural Propeller Tested on Electro

Newly designed Hamilton Standard propeller, now undergoing flight tests on a Lockheed Electra tail-popping transport, features novel tapered blades and solid disk construction. Stress gauges are attached to the blades to determine stress loads in all configurations. The propeller, rated to allow 550 DHP turbine engines, will be installed on 12 KLM Royal Dutch Airlines Electras and on U.S. Navy's YF-14 and advanced warfare models.

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Morristown Pennsylvania



Vertol selected to build new 2-3 ton transport helicopter



Vertol has been selected by the U.S. Army to develop a new 2-3 ton capacity helicopter, destined to write a new page in the mobility book of today's fast striking forces. This multi-turbine powered vehicle (Army designation the YHC-1B Chinook) is a growth version of the company-developed Vertol 107 family prototype.

The all-weather, day-night YHC-1B will be capable of performing such varied missions as redeployment, reinforcement, attack and pursuit. In a logistical role, the aircraft could transport missiles, nuclear warheads and general cargo, and evacuate casualties. Its unobstructed 50-foot long payload compartment, with a straight-in rear loading ramp that can be left partially or completely open or removed entirely to transport extra-length cargo, speeds the entry and discharge of men and material... and facilitates in-flight parachute or free-drop delivery for special missions.

The YHC-1B will not only be able to air-lift tactical units capable of completing assured combat missions, but provide vitally needed mobility within the combat zone. This mobility is requisite in the concept of limited conflicts and, in addition, provides an important offensive and defensive weapon against nuclear attack. In a nuclear situation, the YHC-1B could provide the means for the prompt concentration of troops for attack and their equally rapid dispersion to aegis effective retaliation.

All the proved advantages of tandem-rotor helicopters as pioneered by Vertol will be inherent in this newest Army air vehicle. Large center of gravity range that permits indiscriminate seating and regrouping in flight • Low rotor downwash velocity • Excellent towing characteristics • Rotors high on airframe to permit landing in wooded terrain • Excellent hovering characteristics under varied conditions • Pilot seats low in airframe for ease in jolting clearance • Easy maintenance.

Vertol's years of research in the VTOL-STOL field, personified in the YHC-1B, assure our Pentomic army the mobility, speed, flexibility and freedom from terrain that are among the nation's most potent weapons in preventing aggression.



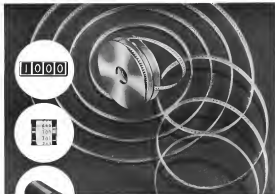
Engineers: Jon Vertol's advanced engineering team

VERTOL

Aircraft Corporation

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permits data selection of the graph and light records.

"Measuring gust variations while airborne is made difficult by the various factors of the motion of the aircraft. These factors are thousands of times greater and indistinguishable from local gust variations. These disturbances forces are isolated out by averaging the readings on the basis of one-minute periodic averages, which are averaged over 3 sec. intervals.

Another problem in airborne gust measurement is caused by Coriolis E-factors changes in the radial radial centrifugal force caused by rotation. These effects, greater when the aircraft is flying in a east or west course, can be as high as 1,200 milligals when flying eastward at 300 mph.

At 300 mph, rate, a change of one mile per hour in groundspeed will cause a gravitational change of 6 milligals. At 300 mph, earth's rotation change of one degree would make an east or west component of 1.5 mph which would introduce a gust effect of 20 milligals.

The aircraft's attitude must also be considered because, as a variation of 10 ft will result in changes in given water content of one milligal.

The General Valley was chosen for the project because of its topography and the availability of accurate maps of the region. The Fairchild B-17 visited some 100 ft of equipment, including a LaCrosse and Rembert mobile cross meter and recording equipment to accomplish the mapping project.

The aircraft was flown at an altitude of 15,000 ft., an altitude more turbulent than the 20,000 ft. flown by the KC-119. Nine flights were made to map the region, with the final one considered too turbulent for vehicle results.

Course, speed and elevation were established by means of photostatic and AFM radar altimeter records in conjunction with maps of the area. In addition to the radar altimeter, the aircraft carried a hypsometer, a pressure instrument for measuring pressure altitude to determine the true pressure of barometric tables. The use of barometric altimeter readings will simplify the task of establishing precise topographic altitudes.

Electra to Tour South America

Lockheed Aircraft Corp. will send a Lockheed Electra on a 16,680 mi., 21 day sales trip through South America, departing Burbank, Calif., on Sept. 3.

Demonstrations will be given at Caracas, Rio de Janeiro, Lima, San Paulo, Porto Alegre, Lima, Bogota, Mexico



Here is a man you should know he's a DELAVAN FUEL INJECTOR SPECIALIST

His name is Paul D. Burgess. He's a master project engineer on Fuel Injector Development, specializing in turbine engines for direct, indirect and primary fuel injection. He's been with Delavan 5 years, and has designed and developed fuel injectors for use on some of the most advanced aircraft engines, scheduled for production in the near future. Men like Paul Burgess, concentrating their talents on fuel injector development, have made Delavan the world's largest turbine specialist. They're the main reason leading turbo-prop, rocket and AFU manufacturers rely on Delavan for fuel injection problem solving.

If fuel metering and distribution are part of your product, take advantage of Delavan's specialized experience and proven ability to deliver exactly what you need. Specifications to the address below for obligation-free recommendations.

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Von Braun emphasized that if a winged vehicle were placed atop a multi-stage rocket, its aerodynamic surfaces would be extremely destabilizing during the powered portion of flight. An au-

sue to this problem, he said, would be to have the aerodynamic surfaces deployed only after powered flight is completed. Inletable structures may be the answer, he added, noting that AEDM was already at work on this area so what he termed the "hypersonic blues."

He was not, he said, "a two-headed monster who is trying to throw airplanes into the ash can." The waste age is now at a point where the technology is not sufficient to prevent man's inclinations and that as knowledge is advanced, man's factors will become high enough to make reasoned flight possible, he said. Although he admitted that there has been little use for pilots in extrinsic experiments, he stressed to the test pilots: "This is not to tell you, however, that your profession is dying. Its greatest challenges lie ahead."

Maneuver-improvements in performance and comfort have been accomplished by a close-up of the design of the Yak-13M single-engine utility aircraft.

The new Yak-12A, powered by an M-14R radial engine, has completed its test program, according to official Soviet engineering sources.

The Y4-12A differs externally from the previous model by having tapered outer wing panels compared with the rectangular planform on the Y4-12B; this change reducing wing area by 13+ sq ft and increasing wing loading from 12.6 lb/sq ft to 14.2 lb/sq ft. Wing bracing was modified; a single strut replaces the former V-strut. Stabilizer

new cushions and is attached to the railings at those points and is supported on both sides at two points, rather than three points and a strut. Wing leading edge ribs are now symmetric—previously they were of the fixed type.

Top speed is now 130-133 mph.

compared to 111.7 mph for the Yal-118.

Foot capacity on the Yak-32A is 57.3 gal. Range at full gross weight has been increased to 621 mi., compared

with 280 sq ft for the Yak 12M. Endorsement is necessary to almost every house. In spite of increase in weight from 3,190 lb to 3,498 lb, the Yak 12A's rate of climb at sea level was decreased by only 1.6 ft/sec; the Russians report and service ceiling decreased 325 ft. Service ceiling is 13,120 ft.

Yak-12As designed are reported to have improved ventilation and heating of the floor plate airplane and installed additional windows on both sides of the

A control wheel has replaced the stick control used on the Yak-11M. The control wheel shaft is used to carry a brake lever connected to FWT main

locking gear brake valve. A locking pin will fix the brake lever in the "brakes on" position.

The Garrett Corp.'s Afterswash Manufacturing Division, Los Angeles, will produce fuel heaters for Boeing B-52 aircraft under \$1.5 million contract. Fuel heaters, which preheat fuel, save

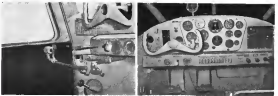


will be installed on production B-GCs and will be retrofitted on all other B-GCs. Heat exchangers utilize engine bleed air to heat -60°F fuel to between 35 and 40°F temperature.

Aircraft Corp., Millville, N. J., will act as distributor and overhaul facility for Rolls-Royce Dart turbo-prop engines under agreement with Rolls-Royce, Ltd., of Canada. Aircraft using the Dart engines in the U.S. are the Victor Vintcent, the Fairchild F-27 and the Grumman Gulfstream.

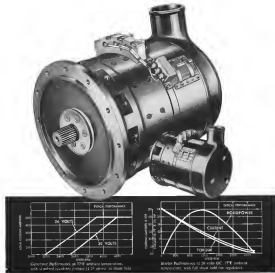
Lockheed Aircraft Service, Inc., Denver, Calif., will handle light data recorders for Boeing, Douglas and Convair for factory installation on Boeing 707, Douglas DC-8 and Convair 440 jet transports. Sales of the Lockheed light recorder total 229.

Carley Corp., Syracuse, N. Y., will supply 15 art conservators to furnish



YAK-12A shuttle is fitted with a lock to stop slippage (left). At right, instrument panel control when engine losses start.

EXPOSITION WEEK, August 24, 1950



One head is better than two . . .

What you can combine the engine-starting and electro-pneumatic generating functions into a single machine is exactly what you can't get, less expensive, less space and less weight per installation.

Along are two views of the famous J&H G-32 starter-generator. More than 25,000 are in service today—ranging as many as 1800 hours without overhaul.

The G-32 design has used the most complete line of starter-generators available from any manufacturer. Machines are rated from under 400 amps thru 750-amps 4-6, and they will

start engines up to 4000-hp thrust, or equivalent hp. They are particularly suited for aircraft and helicopter drives by turbine jet and turbine-propeller.

Control systems for the machines range from simple manual to completely automatic where operation, including "fail-safe" and "ignition-on" is reduced to one push of a button.

For true Starter-Generator Systems *Don't look*—this describes the design and performance of the J&H machine and control systems and also their applications. Write: Jack & Heintz, Inc., 17635 Broadway, Cleveland 4, Ohio

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SYSTEMS FOR AIRCRAFT, MISSILES AND GROUND SUPPORT

compressed air to the four internal combustion cylinders (AW News & 9/9) as the USS Enterprise nuclear aircraft carrier. These steam turbine driven compressors will handle the 1,500 psi air needed by each catapult with one set of three large air pumps. The Bureau of Ships contract totals \$8 million.

Wack Krag Corp., Los Angeles, Calif., will supply jet-powered light duty aircraft to Southwest Coast Airlines, former and Southwest Airlines, for use on Douglas DC-8s, Convair 440s and Sud Caravelles. The order, totaling 76 type aircraft worth, brings the number of aircraft on order to 176, representing a backlog of \$1,160,000.

Pro-Fit Industries Corp., Stratford, Conn., a subsidiary of Avco Corp., will deliver stand air type jet starting units to American Airlines. Self-powered starting units, with a 75 cc jet engine and a 16 mm. diesel tank, will be used for starting the airline's Lockheed Electra and Boeing 707 aircraft.

Lockheed Aircraft Service, Inc., will perform aircraft maintenance and modification work at the National Aviation Facilities Experimental Center, Atlantic City, N. J., under \$600,310 FAA contract. Work involves 12 jet and piston engine aircraft used by the FAA to evaluate air traffic control system.

Rothman-Palmer Co.'s Aeronautics and Instrument Division, Anaheim, Calif., will produce rocket engine test applications for the Convair F-106 under \$504,318 contract. The non-technical test is an airborne computer test to diagnose faulty, solid and liquid rockets. The test is designed to determine engine and fuel control data when the aircraft is being guided by the Hughes MA-1 automatic fire control system.

North American F-106 which is large range interceptor aircraft will be more forward by Rohr Aircraft Corp. and Soler Aircraft Co. They have selected to build the Roberts wing leading edge and control fin.

Metallographic research center will be constructed by R. L. Thalford de Newman & Co. at Baltimore Md., for and in fields of high temperature metals for jet engines, rockets and nuclear and atomic power generation facilities will be completed in 1968.

Aircraft-General Corp., Azusa, Calif. has established an Aero-Space Marine War Air Division to speed completion of a multi-million dollar contract received recently for development and produc-

THE GRAND CENTRAL REPORT

Since merging with Ford Machinery and Chemical Corp. and International Chemical Co. a year ago, Grand Central Rocket Co. has developed an organization of highly competent management and efficient modern facilities. FMC and TGT have set in their path building GCR into one of the strongest, most capable solid propulsion organizations in the country.

With over 100 employees, the seven year old organization (a result of the business) has some 100 engineers and technicians with an average of over eight years of experience in solids.

The nine year old has been augmented with the addition of Mr. John J. Crowley, former director of the Office of Guided Missiles, Dept. of Defense, as Vice Pres. for Project Management and Marketing. Mr. G. R. Mulgrew, former director of propulsion for Polaris, is Vice Pres. for Research and Engineering. Mr. Albert T. Camp, formerly Head of the Propulsion Division, NORTS, is Asst. Vice Pres. and Dir. of Research. Mr. G. Donald Brewer, of the Minnesota machine program, Space Technology Labs, is assistant to Mr. Crowley. Mr. George Chisholm, former staff specialist in the Office of the Dir. of Guided Missiles, is the Marketing and Sales.

An idea of the Company's size is a capacity of 700,000 lbs. of propellant a month to place in the disposal of the Nation's rocket program.

GCR now has the know-how, man, facilities, financial background, and the management capability to undertake successfully any solid propulsion development and production program in the Nation's military and space programs.

It has a complete staff available now—a strong complement of engineers, scientists and support personnel to undertake these programs at once. They are now engaged in company sponsored work on propellants, thrust control, and reliability measures to advance our knowledge and to apply with new and valuable solid rocket engine space. They will not have to be taken off other important projects.

If you have an application requiring a seasoned staff of men and facilities to conduct your participation in your advanced concept studies, or to start immediately on a new development contract GCR, for a prompt response.

Charles Brummitt

Charles Brummitt
Vice President and General Manager

(If you have the qualifications that a long-standing space propulsion team needs, contact our Executive Personnel. Openings now for chemists and engineers.)

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down-time!

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PacAero is the exclusive source for converting Convairst to Allison 505-D23 prop-jets. This is a result of joint design and development planning between General Motors-Allison and PacAero with the direct supervision of General.

Many important changes are included in the conversion, such as modifications of the nacelle, fuel system, heating, controls, empennage, and other elements. What better time to complete the modernization of your

Convair, especially when the modernizing will actually cost less when done at the same time as the engine conversion.

All PacAero materials and workmanship are warranted and certified. And PacAero engineers and technicians are re-recognized to be among the finest in the Aviation Industry. When you bring your Convair to PacAero for the Allison Conversion, consider the important advantages to having these done at the same time:

- Custom interior design, installation
- Radar installation
- Fuel expansion, outboard and/or inboard tanks
- General upgrading of airframe
- Overhaul and service
- Interior painting
- Specialized electronic installations
- Navigation and communication installations

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tion of a new type of submersible torpedo and to expand the company's basic research to ASW detection, under water communications, weapon delivery, ocean surveillance and related activities.

Consolidated Diesel Electric Corp.'s Aircraft Equipment Division, Stamford, Conn., will build transformer-rectifier-type power supplies for starting jet engines under 1450-680 hp. Power contract. Power units will have an output of 1,000 amp at 28 v d.c. lines at input of 210/440 v 60 cycle a.c.

Veto Laboratories, Silver Spring, Md., will build weapon control systems and training devices under three contracts from the U. S. Navy Training Device Center, Fort Washington, N. Y., and one from the Curtiss Wright Co., Charlotte, N. C. The first contract total \$22.5 million.

Lockheed Aircraft Service, Inc. will maintain Navy Lockheed WV-2 and R7V aircraft at New York International Airport and at Honolulu under two contracts totaling \$11,168,360. The New York contract covers the Atlantic WV-2 aircraft based at Argentia, Newfoundland, and Potomac River, Md. The Honolulu contract calls for maintenance work on Pacific-based WV-2 airborne early warning aircraft and R7V transports and will be performed at the Navy facility in Koloa, Lagoon, Hawaii.

Electronic Systems Laboratory is the new name for the Servomechanisms Laboratory at Massachusetts Institute of Technology. Electronic Systems is well known closely describe the control technology, data processing and measuring systems research now being carried out by the laboratory.

Hobbs-Siddley Group has formed an advanced design team to work as experienced transport and space vehicles. Designer of the Canadian Arrow CF-105 Arrow fighter, J. C. Flood, will head the new unit, which is to be staffed by key men from opening companies within the group.

Fokker de Bazel, a wholly owned subsidiary of The Netherlands' Fokker parent plant, has started voluntary headquarters proceedings at San Paulo, Brazil. de Bazel began overhauling training aircraft for the Brazilian government in 1973 as a contract/5% lease.

Avco-General Corp. will produce 15 liquid powered rocket engines under a three year contract and Thor will be modified to build deep space program under a multi-phase dollar contract from Douglas Aircraft Co.



For over a hundred years, the metal that answers to two names—columbium and niobium—has been around with no real pit of its own, although the stainless steel people have and small quantities of the "base" metal as a stabilizing element.

Then about 1957 the people at Tarcos derived columbium, now no longer "base", ought to go to work... at the hot spots in missiles and aircraft.

In the past 18 months, the Tarcos Group, at joint research projects with E. I. du Pont de Nemours & Co., Inc., has evolved cost-conscious ways to produce columbium alloy kippage and sheet-metal parts. These columbium parts will withstand very high combustion temperatures in gas turbines and very high electron temperatures in missile structures and surface parts. Tarcos columbium-working experience includes precision-forging of turbine blades and forging of landing gear components, as well as stamping, welding, and machining in columbium alloy sheet and extrusions.

If your project needs heat-resistance to 2600 F, sustained strength at elevated temperatures, good resistance to high-temperature oxidation, let us show you how Tarcos experience can supply the columbium alloy parts to meet these requirements.



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Welded Modules Reduce Component Size

By Philip J. Klaus

Welding—Conventional technique which affords the use of a single equipment in 75% or more and reduces its weight by nearly as much, yet which also costs conventional components, is assuming industry interest.

The technique, sometimes referred to as "weld-pack," also promises greater resistance to shock and vibration and improved reliability.

Now, recently, invited approximately 4,000 persons participated in a symposium held for the fabrication of welded-pack systems of the guidance computer to be used on later models of the F-4 Phantom II fighter aircraft. Manufacturers were briefed on the technique at the Massachusetts Institute of Technology's Instrumentation Laboratory (AW Aug. 10, p. 71). The welded-pack version of the computer will be only about one quarter as large, and as heavy as the conventional construction and used in only one place.

Technique is the brainchild of Samuel Francis of Francis Associates, Merrimack, Mass., who several years ago initiated MIT's Instrumentation Laboratory in its development. MIT sponsored the development using Air Force funds, usually, more recently, with Navy money, for application to aerial guidance computers.

References to the technique also have come from Instrumentation Laboratory, engineers and from Raytheon.

which was brought in as a manufacturing vendor for prototype hardware. Francis Associates, a consulting engineering firm, set up an office known as Systems Corp., Merrimack, Mass., to fabricate welded-pack units for MIT.

Weld-pack construction is, itself, related to digital computers, where there are dozens of repetitive elements, each using transistors, diodes, capacitors and resistors. However, it is not limited to repetitive elements and should prove to be many types of active equipment, according to Samuel Francis, one of the partners in Francis Associates.

Construction Description

In appearance, weld-pack construction bears a slight resemblance to the three-dimensional sandwich type construction employed by some aircraft manufacturers in which components are mounted to three steel leads between two printed conductor boards. For example, the modules used in portions of the new Air Force AN/ARC-163 avionics RF radio developed by Hughes Aircraft employ this sandwich construction.

Upon close examination, however, the significant differences between conventional sandwich and the new weld-pack construction is apparent. For example, in weld-pack, the components are stacked along the lead instead of, usually, with their leads in direct contact with adjacent components. Such tight spacing is possible because an electrical

insulating solder is used to make electrical connections instead of a conventional soldering iron or solder bath. When a soldering iron is used there is danger of changing nearby components unless sufficient clearance is provided.

Components can be stacked in from almost any desired shape of module. For MIT computer applications, a number of nearby identified logic subelements are built up into a module (called "the stick") which measures approximately as much square as several inches in length. A group of such logic sticks then is stacked together like building blocks into a solid assembly, which is the computer.

Although practical for fabrication of solid-pack units still uses, depending upon the manufacturer, the general outline is as follows:

Transistors are glued back-to-back with their leads protruding from opposite ends. Then, together with resistors and capacitors, they are placed between two thin Mylar tapes with holes punched to secure the component leads. The Mylar tapes serve as a jig for assembling the individual components, much like the printed conductor boards in conventional sandwich construction. However, the tapes have no interconnecting conductors.

Nickel Ribbons

When the system expansion, from units and ribbon components, has been installed, with their leads protruding through holes in the tapes, thin ribbons of nickel are welded in appropriate leads to interconnect components into a group of submodules.

The stick now contains a series of submodules which are not interconnected. The manner in which these submodules elements are interconnected will depend upon the function to be performed. Components which need no further electrical connections have their leads clipped off in this, do not extend beyond the nickel borders.

The nickel ribbon borders are next insulated from the interconnect conductors which will follow by covering them with another Mylar tape, also with holes which permit remaining component leads to protrude.

Two more Mylar tapes each containing a grid in inches of metal wires, one then prepared by plating series of wires along the length of the tapes on one side, with a series of wires running transverse on the opposite side of the tape. At corner positions, de-

termined by the required interconnect connections, tiny holes have been punched in the tape on the longitudinal and transverse wires can be welded together to provide desired connections. These wires in the matrix which are not needed for electrical connections for the particular logic function having fabricated are clipped off and discarded.

Component leads which were not clipped off earlier, protrude through tiny holes in the tape and provide the means for connecting the individual submodules to the matrix. When all such connections have been made the stick is now a major subassembly of a digital computer.

Until the time the matrix tape application step, the stick is relatively untested, each stick is identical. The configuration of the matrix tape determines the function the stick will perform.

Stick Encapsulation

Input/output connections to the logic stick are provided also by the longitudinal matrix wires which are brought out to a set of combined terminal block/conductors at one or both ends of the stick. Then the stick is ready to be encapsulated. Components which dissipate the greatest heat usually are located along one of the external surfaces of the stick. If this is not adequate, thermal conduction can be brought out to a metal heat sink plate, which is attached to one surface of the stick.

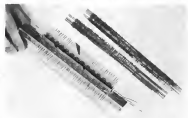
Instrumentation Laboratory has developed a technique whereby an IBM 650 digital computer can be packaged to derive the optimum layout of components and their interconnections for logic sticks. The 650 computer and its output equipment produce a physical layout which can be photographed, reduced, and used to print a wiring diagram showing required actual connections on the strip of Mylar tape.

Using conventional semiconductor components, it is possible to achieve packaging densities of at least 140,000 components per cubic foot. If microminiature laminated type transistors and capacitors are employed, figures of up to 500,000 can be achieved. By use of components, a density of 35,000 to 50,000 components per cubic foot is about the best that can be obtained with conventional printed conductor board construction.

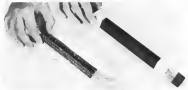
Furthermore, these packaging densities can be achieved for other components, not merely for a few isolated modules. The irregularity configuration of the weld-pack sticks provides maximum space utilization without the wasted areas frequently found in other conventional equipment. All of the



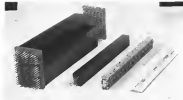
USE OF DISCHARGE WELDER to assemble weld-pack modules and make all electrical connections promises to improve reliability, make unit less vulnerable to shock, vibration



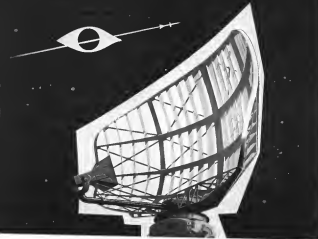
COMPONENTS are first sandwiched between two thin Mylar sheets with their leads protruding through holes in the sheets. Then nickel ribbons wire is welded in place to connect components into group of individual submodules. This interconnect submodules in the module, two more Mylar sheets with grid of wires are prepared (right)



AFTER TWO STRIPS of Mylar are added to isolate persons seeing, the two strips with series of interconnecting wires are added and soldered at appropriate locations to connect leads to form a complete encapsulated module (left). After encased component leads have been trimmed off, module is encapsulated (right). Longitudinal matrix wires provide input/output connections to module. Configuration of matrix tape determines function stick will perform.



WELD-PACK construction, which cuts out of source equipment by 75% with comparable weight reduction will be used by Navy for Polaris guidance computers. Technique developed by Francis Associates for MIT's Instrumentation Laboratory, can provide packaging densities of up to 500,000 components per cubic foot using conventional semiconductor components compared with 35,000 to 50,000 components for conventional printed conductor board construction.



THE WHITES OF THEIR EYES.....

The whites of the enemy's eyes are now visible half way around the earth— thanks to technological contributions from Stavid in the area of long-range, both microwave detection and high-power radars.

When it becomes operational, the high power Early Warning Air Search Radar now being developed by Stavid will greatly extend the range of these in use SEW line defense network. Inconceivable in radar transmitter design will provide a compact, high-power system, achieved through new techniques in side lobe suppression and antenna gain.

Every new advancement in long-range detection finds Stavid in the vanguard, working with cosmic as well as man-made electronic techniques.

OTHER STAVID PROJECTS INCLUDE:

- Stereo Locating System (AJPMS-3)
- Electronic Beam Steering Sub-system
- Antenna System (ANSPA-1)

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Imaginative Electronics...

Outstanding engineers and scientists are needed to help us take opportunities on Stavid's advanced systems engineering teams.



Anthony explains engineers, A. J. OLLANDER has 5 years' experience in microwave microwave and related systems. He was at STAVID for 10 years, working on the SEW radar, surface search, and ground, target detection systems, including a major design of Dr. R. K. Smith.



CONVENTIONAL welded construction, as in the case from Higher AN/ARC-16, also have some advantages to welded construction, but one serious drawback and is less compact.

Wiring required to interconnect sub-circuits is integral within the stack, while all of the wiring required to interconnect individual stacks into a core plate equipment is contained in the end terminal board, connector to which they are attached.

Once the stack has been encapsulated, it exhibits extremely high structural strength for much the same reason that reinforced concrete is so strong. The nucleus of solid metal wire and ribbon in two places, and the closely stacked components in the third place, act much like the steel rods in reinforced concrete.

This, combined with the extremely compact lightweight construction gives each stack or module a very high stiffness-to-weight ratio. When a group of stacks are stacked side-by-side into a complete assembly, additional structural reinforcement and rigidity is achieved.

Regged Construction

To illustrate the superiority of the welded construction, Edgerton quotes the following list of stack characteristics which the stack can withstand without difficulty or malfunctioning.

- Vibration: 50 g's peak sine wave from 75 to 2,000 cps, in three axes, as specified for total of 12 hr.
- Shock: 150 g's of 11 ms. half sine wave, 1,000 g's of 0.5 ms. impulse.

The use of welded instead of soldering is justified by inspection of all sub-stacks and bonded terms to date substantiate this supposition. Although considerable experimentation may be required to determine the best design, design, inspection and electronic design applied to produce a good weld once these have been established the operation is much more consistent than soldering and is less dependent upon the individual operator's skills. These factors count.

Furthermore, a defective weld results is far easier to detect by visual inspection than is a poorly soldered connection. From products that it should be possible to produce an average of more than one million welded connections.



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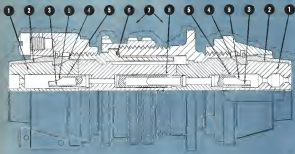
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STUB R Check the PLUS features of the NEW Amphenol "R"!

Stub R is the newest member of AMPHENOL's family of fully approved MIL-C-5035D environmentally resistant connectors. The "R" construction is a recent addition to the Specification and is described as "environmentally resistant—light weight". Like AMPHENOL's superior Stub R, the Stub R offers plus features above and beyond the minimums established by the Specification. Together, these connectors provide users with a complete solution of the shortest, lightest, easiest-to-install, most reliable AN/MIL connectors available to MIL-C-5035D customers. Stub R connectors offer the following plus features:

- Slippery Greasent Material:** A special neoprene material that allows easy slippage over wires. A cost-saving advantage that speeds up assembly.
- Utilized Rear Greasent Greasent:** cheap nut, cheap shell and retaining ring form a single sub-assembly making assembly and disassembly easier and quicker than with any other "E" or "H" connector.
- Uniformly Tinned Solder Pockets:** Uniform and complete distribution of solder filling in the voids of the solder pockets, ensuring the ease of producing the best electrical and mechanical connections.
- Metal-to-Metal Bottoming:** The crimped rear greasent provides metal-to-metal bottoming to the inner shell when the greasent is fully exposed, ensuring pre-determined, controlled seating and removing the possibility of compression "air".

- Base of Soldering:** Bolder products are exposed for easy wiring and soldering, providing fast, low cost and high quality assembly.
- "Q" Ring:** The Stub R incorporates an "Q" ring on the shoulder of the MS 3106 plus for additional sealing protection.
- Shorter Length, Lighter Weight:** Stub R and Stub R are the shortest and lightest types available, allowing for more compact equipment that saves money where weight is money, as in aircraft.
- Closed Entry Socket Contacts:** Designed to test port design, female contacts are cushioned in a copper alloy and protected with a closed entry.
- Positioned Contact Pockets:** All solder pockets flow in the same direction, accelerating wiring and substantially reducing assembly costs.



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INDIVIDUAL modules are assembled into a complete computer, or device in future years here after which a common plate is attached to interconnect all module wires.

per undetected defective weld. By using welding requires only a brief and accurately timed burst of heat, there is far less possibility of damaging heat-sensitive components like transistors and diodes during assembly, according to Stephen Coddie of the Instrumentation Laboratory. This results if possible to weld-connect a component at a point distal to its body eliminating the space and weight of long leads for dimensions of components.

Instrumentation Laboratory has been conducting life tests of one complex circuit, containing 7,500 transistors and diodes and 1,000 capacitors and capacitors, subjecting it to voltage cycling, but no shock or vibration. After nearly 7,000 hr of operation there has been only a single failure—a silicon transistor—Coddie says.

Ruthless, in life tests which now total "thousands of hours," has not encountered a single failure, according to a company spokesman.

Once a solid pack unit has been encapsulated, replacement of a failed component is impossible. The entire unit must be discarded. Even before encapsulation it is a moderately difficult to replace a defective component after the matrix type has been installed. For this reason, companies are thoroughly trained prior to assembly and at key steps in the fabrication process.

At first glance it might appear that solid-pack construction would be considerably more expensive than conventional printed board construction. However, AT&T, Raytheon and Sylvania all say that it is directly comparable for both pilot and long-run production quantities. If mechanical assembly facilities were developed, Coddie believes the solid-pack technique might prove substantially cheaper than conventional processes.

France Associates has been granted

our basic patent on the solid-pack technique has several others pending, as well as those from France. However, the government has issued the rights because of its funding of this development.

France Associates currently is working with several outside companies, as well as in adapting their circuit for solid-pack construction and in setting up their own in-house solid-pack capabilities.

Both Raytheon and Sylvania which are producing pilot quantities of solid pack units for Instrumentation Laboratory, are now looking into the outside companies. Newly formed firm, called Data Instruments Corp., West Newton, Mass., also plans to produce solid pack units under contract.

Sylvania does not plan to bid on Navy's forthcoming solid-pack guidance computer production program, but Raytheon probably will. Other companies that were invited to bid include AC Spark, Philco, General Electric, Hughes Aircraft, International Business Machines Corp., Kollsman, Lockheed, Minneapolis-Honeywell Radio Corp. of America, Sperry Gyroscope and Texas Instruments. Hughes and IBM, however, have been in ongoing welded construction techniques on their own, prior to the recent bidding on solid-pack construction.

Became one of the techniques in

valued and tender to those used in the manufacture of vacuum tubes, tube sockets may move into the field to some extent for possible loss of market to semiconductor. Raytheon's solid pack work is handled by company's Industrial Tube Division.

Capital Links Cities With Univac System

Washington—Capital Airlines recently inaugurated its Remington Rand Univac electronic reservations system, making 75 calls on the current routes with its Washington headquarters. On long 175 airport now connected by long line telephone network with a computer at Washington space control, the system handles seat sales and cancellations and provides seat availability, weather and flight status information when the computer is queried.

Capital cities not directly linked to the computer are served by two special agents now located in the space control headquarters. Telephone transactions and inquiries from these cities are relayed to and from the computer by one of these agents.

The Univac FileComputer makes use of five magnetic drums, each with a 180,000 character storage capacity. It provides information on a 2 million seat inventory.



Eight Circuits Mounted in Frame

Aviation contractors built by Stanford Research Institute consists of two sets of eight circuits mounted back to back in a bonded aluminum "vacuum frame." Single 20 pin core driver provides connection for complete assembly.



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Avionics Profits Rise In 1959 First Half

New York-based avionics manufacturers' financial returns for the first half of 1959 are showing a healthy increase in sales and an even stronger rise in profits over figures reported during the same period in 1958. Here are a few representative examples:

• **Textron Instruments, Inc.**, reports high-cut sales and earnings for its second quarter and first half in the company's history. Second quarter sales were \$51,463,000, up 137% from the second quarter of 1958. Earnings during this period were \$1,122,000, equal to 56 cents per common share, an increase of 170% from the previous year. Total sales for six months of 1959 were \$94,199,000, up 124% from the first half of 1958. Six months net earnings were \$6,805,000, equal to \$1.61 per share. The latter is an increase of 147% over the previous year. The company expects 1959 sales to total approximately \$200 million, more than double last year's \$99.5 million. Present backlog is \$61.7 million of which about \$42.3 million represents direct government contracts.

• **Loan, Inc.**, reports a 12% increase in sales for six months ending June 30 over the previous year's first half with a 70% increase in net earnings over the same operating period. Total sales for first half of 1959 were \$38,576,000, with profits of \$1,124,000, equal to 44 cents per share. Per share earnings last year in the same period were 27 cents on a slightly lower number outstanding. Second quarter sales were \$21,383,000 with earnings of \$723,000, equal to 28 cents per share. This represents a 74% increase in sales and a 75% increase in per share earnings over the same second quarter of 1958. The company reports a June 18 backlog of \$74.5 million, 10% higher than as of Jan. 1, and 109% above the backlog of a year earlier. Shipments in the last half of 1959 are expected to exceed \$42 million, for company records.

• **General Precision Equipment Corp.** reports second quarter sales of \$18,516,000, an increase of 30% over sales in the same quarter of 1958. Earnings were \$1,161,114, equal to 77 cents per common share after dividends, as preferred and preferred stock. Earnings for the same period of 1958 were \$253,250, approximately equal to preferred dividends paid. Sales for the first six months of 1959 were \$102,301,499, an increase of 33% over the first half of last year. First half earnings were \$2,063,173, equal to \$1.34 per share of common stock after preferred dividends, an increase of 174% over the \$774,954 profit for 1958's first half, which was equivalent to 16 cents for each share of common stock after pre-

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Raytheon Studies Unmanned Space Platform

Raytheon Co. has awarded a \$50,000 study contract from Wright Air Development Center for the company's proposed autonomous unmanned aircraft, designed to serve as a flying platform for reconnaissance, relay or extended-range communications (ENR Aug. 17, p. 14). Platform would be designed to learn on receiver energy beamed to it from the ground.

ford dividends. The company's backlog as of June 30 is \$206 million, 10% above figure on Mar. 31, 1990, and 21% above backlog as of Dec. 31, 1989. Sales and earnings are expected to show continued rapid growth during second half, the company says.

• **Chicago Aerial Industries, Inc.**, reports first half sales of \$6,807,478, up 50% over first half of 1989. Earnings of \$400,025, equal to 7% net per common share, next up \$650,000 (previous year's first half). The company looking outside \$6 million.

• **Electronic Communications, Inc.**, reports sales of \$24,757,492 for the first nine months of its fiscal year, an increase of 68% over the same period last year. Net earnings were \$261,179, equal to \$1.90 per common share after a preferred dividend. That is, a 50% increase over dollar earnings last year. For the third quarter, the company reported sales of \$7,784,812, up 76% for the same quarter last year. Net earnings were \$267,116, equal to 66 cents per common share, compared with a net loss of \$5,556 for same quarter of 1989. Company backlog as of June 30 was \$12.2 million.

• **The Spigot Corp.** reports net earnings of \$2,153,323, equal to \$1.76 per share for third year ended June 30. Per share earnings are up 75% over last year's figure, with about 6% more shares outstanding. Sales for the year totaled \$77,076,841, approximately 6% above the previous year's figure.

selective voice communications between that room and the control tower. It also provides fast local line contact with other control facilities in the Air Force. Increased volume of air traffic and the advent of the jet transport necessitated extra radar rooms in the San Francisco tower which threatened overtaxing of operations and equipment. Under the direction of Chief Controller E. P. Sullivan, a separate radar room on another level was designed. Pacific Telephone & Telegraph was requested to work out an intercom system to replace face-to-face conversation and occasional shouter-tapping back characteristic of conventional communications between radar and control personnel.

The result, after 35 months of development and engineering, was the AT-1. Heart of the system is new Western Electric 598A key switchboard, one-fifth the size of the standard Western Electric 1624 unit. Through two key switchboards located on panel of each operator, one of the eight stations which make up the control tower radar room complex, can communicate continuously with any other station merely by pressing a single lighted key.

If the key is down the key will dial brightly but an override feature automatically cuts the dial key on the down position of the key presses the key again. The system, which contains 35,000 separate wire connections, cost about \$51,000 to develop and install. Other features include:

- **Lightweight headsets**, about the size of a large hearing aid speaker.
- **Modular construction** of the keyboards permitting fast replacement for maintenance purposes.
- **Dual phone jacks** for training purposes.
- **Hot-line backup system**, consisting of

a backupboard which extends all point-to-point communications in event of emergency.

• **They backpedal** at each stop, which automatically cuts the voice of the pilot in flight when the radar operator is speaking on a land line.

Most significant feature of the new radar room is the one with which the radar equipment can be maintained. Doors behind the workstation back is a brightly lit work area, in which repairs can be made with a minimum of interruption to operations. The room itself, part of an addition built in 1978 at a cost of \$115,000, features soundproof, carefully selected acoustic lighting. Each radar station has compact overhead night-type controls.

Japan Vies for Sales In Avionics Market

Los Angeles, Calif.—Rakusa Japanese precision avionics are producing high quality, low cost avionics products which are so competitive with U. S. bank parts that American companies are "falling out themselves" trying to beat out the Japanese firms, according to Frank A. Kashi, president, Teier Inc., manufacturer of aircraft terminal blocks here. He returned recently from a tour of Japan during which time he was a guest of Japanese avionics and chief speaker at the First International Symposium on Reliability and Avionics held in Tokyo.

According to Kashi, several large U. S. companies, among them International Business Machines and National Cash Register, already have set up joint ventures and are turning out precision electronic equipment on a par with those with which U. S. companies cannot compete due to lower Japanese labor costs. He deplored the common American conception of the shoddiness of Japanese built goods and controls, the caliber of their products is excellent. In Kashi's opinion, the quality of Japanese built equipment, the many errors, digital readout equipment, etc., is superior to the products of U. S. firms.

Automakers has not been neglected by the Japanese either, he said. Even last laboratory facilities are available to study automation possibilities and even though labor is cheap, automation is pushed to achieve high volume. One Japanese plant alone, he said, turns out over 1.5 million transistors a month using fully automated processes.

Does any gradually being closed to U. S. interests, he was asked, citing that the American export Japan accord was U. S. dollar and technology. Capitalism was no longer needed due to a steady strengthening of the Japanese yen on the world market and Japanese tech-

New Avionic Products: Battery, Doppler Radar

Radio battery to power repeater amplifiers in microwave radar consists of a series of segmented cells which makes the battery flexible enough to fit under a cable even when wound on drums. The one-inch diameter battery, developed by Ampex-Carl and for Sony Signal Research and Development Laboratory, is several times as small as wires. The battery measures 1 m in diameter and is 30 in. long. It delivers 5 w. current at one volt for periods up to one year.



Rakusa 500 microwave doppler radar developed by Ground Systems Laboratory, weighs 68 lb., is accurate to within one foot plus 0.2% for ground speed indication and is within 0.2 deg. in drift angle determination. Equipment is a two-channel, pulsed, self coherent type doppler radar and is designed to meet characteristics 548.



Teier 5000 computer, for use with Rakusa 500, is dual channel device which computes distance to go to destination on way point and perpendicular distance off desired track. The transmitter, YNC-30 computer and control panel weighs 25 lb. and is accurate to within 1 m. at 3,275. Computer also provides output signals for use in automatic pilot.



IFR ROOM of San Francisco International Airport has overhead controls, subdued lighting

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technical capabilities, has progressed to the point where, outside help is no longer required. Kaula said. Some companies have set up facilities in Japan only to find that getting offload out of that country is almost impossible, and he added trade restrictions as an example that a firm of American lawyers in Tokyo has been specializing in these problems for some time.

These problems are ripe to U.S. business who want to take advantage of low Japanese labor costs Kaula said. • Establish their own manufacturing facilities in Japan. This is difficult because of the "low point" which exempts the agreement and results in a difficulty in getting money out of Japan. • License a Japanese company to manufacture products. The same drawbacks are inherent in this arrangement as in the preceding one. Additionally, pro-

tection tariffs are large prices to the U.S. consumer as high as domestically manufactured goods.

• Buy into Japanese industry—difficult because U.S. capital is no longer sought with the same fervor it once was.

In Kaula's estimate, the Japanese lack one important tool and resource in the U.S. for scientific research and development, the transfer of technology. Research in Japan is conducted on an individual basis to solve problems in their own countries. Industry and government do not seem to take advantage of research skills available in universities and the government and results are not being transferred. He agrees that this is a lack of coordination on the part of industry due to a deficit of board representation. That the Japanese are aware of this is evidenced by their



Marconi Demonstrates Avionic Systems in Air

Marconi radio communications equipment and navigation aids are installed in a Viking Viking for demonstration purposes. Top photo shows part of the cabin with the demonstration panel on which the primary navigational instruments are installed, in addition to those in the cockpit. Photo at right was taken just after takeoff. Equipment includes Marconi MD1300 display integrator, Type MD112 radio compass, Type MD772 navigation radio compass, Type MD607 high power HF communications transmitter/receiver, Type MD607 VHF multi-channel communication transceiver, with associated Type MD604 antenna, Type MD605 antenna heliometer receiver, and VOR/ILS equipment.



In addition to the 21 companies which have selected the Fairchild F-27, twelve total airlines are flying the proved performer in daily scheduled service. Outstanding short-field capability, permitting operations at many airports closed to other propeller-driven aircraft... air conditioning on the ground and in the air... are a few of the outstanding features that make the F-27 the air traffic manager of the Jet Age—and first choice of airlines and corporations.

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work selected in all design, limited to end management training methods.

So far, impact of the Japanese pressure industries has not been felt in the U. S. defense buying programs, but local buyers of our governmental policy to end buying U. S. made items. This is not to say, according to Kondo, that Japanese-made manufacturers could not be forced in a computer-controlled hand in the U. S. for a commercial contract. And used on a defense contract. He concluded however, that direct contracting or procurement of items for defense is not being done.

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► **British AEC Research-Radio Division of Radio Corp.** will manufacture and distribute in terms of an air-coupled transducer system, developed by General Radio and Electronics Ltd. of London. These devices become an area being modified in BOMAC's Boeing 707 instrumentation, get transport. The device is said to be 71% transmittance and capable of accommodating up to 100 kHz. It occupies 3 ATR and weighs 18 lb.

► **Stane E&E Inc.** has developed a new temperature measurement device

18,000° and while the planar, vacuum and surface diodes at photo-stimulated levels reach temperatures of -230° and colder. This picture of Jupiter's atmosphere, captured in color at the University of California Institute of Technology's Radio Observatory, is shown in a color similar to the sun's, or a radiation belt like that around the earth, satellite way.

► **How High and How Fast—An air force competitor that will employ in forced detection to meet or determine altitude and speed of a photo-stimulated aircraft is being developed by Avion Division of AEC Industries, Inc.** The computer, called the V/II (V for vector height) is used in a forced detection to meet or determine altitude and speed of a photo-stimulated aircraft. The computer is used in a forced detection to meet or determine altitude and speed of a photo-stimulated aircraft. The computer is used in a forced detection to meet or determine altitude and speed of a photo-stimulated aircraft.

► **Marin Propulsion—Development of a solid-state clock and time program for the Project Mars can be un-**

der • • • at Watkins Precision Instruments Co. under a subcontract from McDonnell Aircraft Corp. Called a chronometric program, the device will record elapsed time from launch and automatically set a motor on a precise schedule 17 activities including re-entry into the atmosphere. The unit also will generate signals to be transmitted to the ground through the telemetry system.

► **Two-Story Tube—Super-power micro wave tubes will be tested at Radiofac in terms of a modulator 100 ft long, believed to be the largest in the world. The two-story modulator modulators will be tested in a special 10,000 sq ft wing to be added to Radiofac's Spencer Laboratory.**

► **Australian Division of North American Aviation, Inc.** has received a \$5 million advanced go-ahead contract from Lockheed Aircraft Corp. for electronic automatic control system for the F-104C, modified to 30,000 ft. Sensors will provide the fighter with altitude, air speed and air-to-ground attack capabilities. Avionics NASAR will provide information for both high and low level maneuvers such as air-to-air, automatic tracking control ranging and terrain avoidance.

► **Boeing Aliphase Co.** awarded \$100,000 Mustang XCM test program subcontract to United Electronics Division, Inc. for design development and fabrication of 150 FM airborne telemetry system to be used for collecting and transmitting data during test program. First prototype system to be able to fly in January, 1960, is fundamentally the same system as designed by company for Alfa, Tico, and Pioneer 1.

► **Airborne Instruments Laboratory** heads on eight contract teams to design and develop airborne electronic systems component for U. S. Air Force under a \$158 million contract. Other modules are Aeroquip-Gurum Corp. Filton Co., Inc. HRE-Singer, Inc. Raytheon Co., Sperry Gyroscopic Co. Sperry Electronic Systems and Teco Corp.

► **Shaw 7401** of the end of the British Navy Eagle air force model, will go for electronic guidance and control, which is under development by Sanders Associates Inc. of Nashua, N. H. Launchers are not yet been designated by Navy.

► **Radar equipment for Air Defense Command's Aircraft Data acquisition network will be manufactured in Canada by Division of Aero Corp.** and a \$21.5 million contract awarded by U. S. Air Force. Radar is 10 ft in diameter

and is installed on a steel tower which is 100 ft high.

► **Collins Radio Co.** has received a \$1.7 million Navy contract to produce four receivers for ship and submarine use in detecting and tracking aircraft from ocean surface. Each device is to receive and 242 vacuum tubes, 170 diodes and transistors and requires about 14 kw. of electric power. Navy says.

► **Nationwide weather forecast** on radio which can provide high altitude weather information to 15 U. S. Air Force bases at double present frequency speeds has gone into operational status. Known as Strategic Forecast Center, the network was designed and installed by Western Union Co.

► **Hillhouse Electronics Division of Stager Corp.** has received a contract from Army Ballistic Missile Agency, Huntsville, Ala., to install seven air-coupled remote TV camera installations. Units are designed to withstand shock waves of highest known sound velocity level of 175 db.

► **Duranton-Picote** met awarded a subcontract for \$105,400 for development work to be used in the Mountain research and development program by Avionics, a division of North American Aviation, Inc. Avionics is responsible for guidance and control system.

► **Air Force** has been selected by Defense Department to set up purchasing agent for three services for common electronic tubes and for the three departments with full implementation of an acquisition by Mar. 11, 1960. During 1959, three services bought 548 million worth of electronic tubes, of which USAF accounted for more than 50% of the total.

► **Westinghouse Electric Corp.** net sales were \$914,394,000 for the first half of 1959, or against \$925,960,000 for the corresponding period last year. Net income was \$54,193,000 for the first six months of the year, compared with \$15,775,000 in the first half of 1958. Earnings were \$1.92 a share for the first half of 1959, compared with \$1.30 a share for the same period last year.

► **Inducton Motor Corp.,** Woburn, N. Y., maker of various equipment for aircraft and aircraft use, has acquired Mass. Electric Corp., Los Angeles, Calif., through a stock exchange. Corporate name has been changed to BMC Magnetics Corp.



You Get MORE POWER—Less Weight with the New CHERRY G-85 Lockbolt Gun

The new Cherry G-85 lockbolt gun is designed to give you maximum pulling power with less weight. Its simplified rugged construction assures low maintenance costs. The gun weighs only 10.5 pounds, which reduces operator fatigue.

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Scientists Study Spacecraft Shielding

By Russell Hirskey

Los Angeles—Materials in the direct-path ecological system of a nuclear-powered spacecraft can use much weight in shielding in a shield against direct neutron radiation from the power plant, Robert E. Trapp and Eugene D. Kerner of Douglas Aircraft told a technical meeting of the American Astronautical Society earlier this month.

The study covered the shield replacement problem with heat exchanger, reactor neutron and neutron source propagation systems. Best location for life

systems, materials to save at shield replacement was found to be the heat of the crew compartment. Van Allen and cosmic radiation from the power plant, on the other hand, an important effect on shield requirements under prolonged operation in the lower Van Allen belt is planned.

Radiation characteristics of heat exchanger, reactor neutron and neutron source system after direct neutron radiation from the shield of the reactor, high level neutron radiation from the shield of the reactor, neutron source system and secondary neutron source system produce low level neutron radiation. Radiations include

for the smallest possible design requirement of the system, for no better than small the exposure to neutron radiation there will be some damage to the system.

Among other requirements for space flight is a meeting ecological system to protect life, save from the cosmic environment. It is logical to make an action be useful for more than one purpose, because of the direct neutron radiation of space flight. The reactor neutron shield, the direct ecological system from the shield of the reactor, neutron source system and secondary neutron source system produce low level neutron radiation. Radiations include

Early replacement of different parts under various conditions of activity will depend on age, body size and medical condition. But the overall activity, average mass metabolism about 3,000 kilocalories of metabolic activity, is not precise.

To study the data used, he would estimate 2 lb of oxygen, produce 2.5 lb of carbon dioxide, requiring about the same weight of nitrogen, hydrogen, to study it, and 5.7 lb of water to load and dump, and cut 2 lb of mass for a total total payload of 32.2 lb per day.

Most of the acquired materials can be carried and returned for transportation between one and 20 days, but for long-term more than 10 days conservation of materials by construction and cycling of waste can become possible, if weight of equipment and power supply does not exceed weight of life physiological requirements.

Present weight estimate for a mission shield ecological system is about 680 lb which consists of low advantage in the state of the art as well as availability of power. A more realistic weight is probably closer to 2,800 lb per man.

It is apparent that for long-duration flight, 1,000-day mission, except transfer orbits to Mars and back, a human crew would need a total payload of 30,000 lb without recycling. With recycling, this figure could be reduced to approximately 12,900 lb that is 7.3 lb per day per man rather than 12.2 lb per day per man. A complete, light-based recycling system could be expected to nearly approximate the state-of-the-art of light recycling. The state-of-the-art of present-day design is an open system to recycle 2 lb of food per man per day in addition to the complete light system.

Recent Douglas proposals and

other systems, the shielding problem is simplified in the situation of gamma radiation. Shielding requirements, at the total payload can be calculated by reducing an attenuation coefficient and those of shield materials as a function of gamma energy.

Shielding Requirements

High molecular weight shielding is most efficient for the removal of gamma radiation with energies below about 1.0 meV and about 0.7 meV. Low molecular weight materials which constitute neutron requirements provide economical shielding in the intervening energy range. Calculations of gamma shield requirements capabilities of the neutron materials used based on the following analysis of the chemical composition of the neutron material:

Daguer-9.80 lb./m²./cm².

Hidrogen-0.87 lb./m²./cm².

Carbon-0.86 lb./m²./cm².

Lithium-0.79 lb./m²./cm².

Shielding is done in a shield against cosmic radiation. Other materials in the basic composition, such as the neutron source, are not used to produce little effect.

Direct radiation from the reactor during the crew compartment will be more complex than scattered radiation. A large portion of the direct radiation will be in the energy level between 0.5 and 5.0 meV. Most of the scattered radiation will be in the range from 0.1 to less than 1.0 meV. The shielding that life-sustaining material is effective in shielding against direct radiation while considerable efficiency is realized by using it to replace neutron shielding.

Shield Replacement

Gamma shield replacement capability for direct radiation may be on the order of 8 lb of shield replaced by 10 lb of neutron material, while a comparable value for scattered radiation will be on the order of 10 lb for every 3 lb of shield. Shield capability of neutron material need not change with time. Since the neutron and gamma flux of neutron material will remain constant, that which enters the crew compartment will be replaced in shield by a waste product.

Two examples of what can be done by replacing shielding with neutron material were presented. The example dealt with direct radiation to Mars using 21,000 curies neutron power and hydrogen propellant with a specific impulse of 365 sec. Resources and two examples are as follows:

• The reactor is operated on both earth and Martian atmosphere, therefore a neutron shield is required. At a reactor core diameter of 180 in., the earth-to-Mars reactor core dose with 25,000 lb of neutron shielding would

be 5.2 rem (average open door duty) and the direct core dose would be negligible since the design provides for the neutron trap would be used as the direct shield. The Mars-to-earth trip would result in 72 rem with 25,000 lb of the original 25,000 lb of neutron shield in a neutron shield and the remaining 10,000 lb used in a direct shield, thereby giving the crew another 3.3 rem, or a total of about 77 rem in the 1,000-day trip. Without shielding of any kind, a crew of three would require 30,000 lb of neutron material and all of this could be used as a neutron shield for the rest of the earth's atmosphere. As a neutron shield the neutron source material only requires 10,000 lb of the direct neutron source material. The difference of 14,000 lb would have to be carried in addition to the neutron material on the return flight through the Martian atmosphere. The 10,000 lb of neutron shield would be composed of 14,000 lb of shielding material and 3,600 lb of neutron material would be required. The direct shield of 10,000 lb could be replaced with only 12,500 lb of neutron material. The remaining neutron material would now be waste material and could be left behind.

• The reactor is not operated within the earth's atmosphere, therefore the neutron shield is required. At a neutron core diameter of 180 in., there would be no neutron or direct dose on the earth orbit to Mars orbit flight. On the return journey, a direct shield of 10,000 lb of neutron material would keep the crew dose down to 1.7 rem after direct dose in the case of the three crew members did not regenerate any material; they would begin with a payload of 30,000 lb and would require only 12,500 lb of neutron material to protect themselves against the direct radiation on the return trip from the Martian orbit to the earth. It should be noted that in this case of return, the availability of power and an 80 lb water production apparatus the total payload for the 1,000-day journey would be reduced to 22,400 lb. With only 12,500 lb of the neutron material used in a direct shield, the crew could be protected against the direct radiation. In this case, about 10,000 lb of biological waste material could be left in the Martian orbit. Another radiation could be secured that is the production waste purification and not represented by a chemical waste recycling system. In this case, the



Atlas Gets Air-Transportability Test

Assembled Corvus Atlas intercontinental ballistic missile is loaded into a mockup of a Douglas C-119B Carquester transport at Long Beach, Calif., as part of a study of air transportability tests. Atlas rocket motor is not installed. C-119B is currently in production at Douglas Aircraft's Long Beach facility.



Thor Engine Fired After Freezing in Test Chamber

Boeing's 170,000 lb. Boost engine for Thor intercontinental missile made its debut on Monday after 25 hr exposure to freezing temperatures in an environmental chamber. Engine was exposed to the dry of 100° F and the wet of 100° F in the Rockwell Division of North American Aviation's Pomona Field Laboratory.

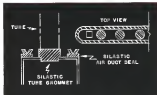
The PLANE

America's newest production bomber, the Convair B-58 Hustler. This delta-wing jet employs an area-ruled fuselage for superior ride efficiency, and has reportedly been flown in excess of Mach 3 at 50,000 feet. Engines are four J-79's, in pods below the wings.



The PROBLEM

Sealing and cushioning vacuum tubes in cooling air ducts for the B-58 Fire Control System, designed and produced by The Emerson Electric Manufacturing Company. Difficulties involved include heat—the sub-miniature tubes operate as high as 350 F—and severe cold when the seals are inactive during flight. Protective material must stay resilient despite these extremes.



The PART

SILASTIC
Silicone Rubber

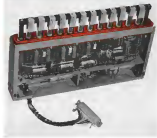
Tubes and other electronic equipment in the B-58 are cushioned by molded parts of Silastic, the Dow Corning silicone rubber. Silastic 54373 rubbery, has excellent electrical properties.

TYPICAL PROPERTIES OF SILASTIC MOLDED PARTS

Temperature range, °F	-130 to 500
Tensile strength, psi	800 to 1400
Elongation, %	150 to 500
Compression set, 24 hr, 250°F	300 to 500

For further information write Dept. 8000

DOW CORNING CORPORATION
MIDLAND, MICHIGAN



vid peeled could be reduced to 14,400 ft, at which 12,500 ft would be used as the direct shock, on the return flight."

These examples show that vid peeled people could sit on the nose of 10,000 ft on mission post-acting planar atmosphere with no receding of vid peeled and can produce, average approximately equal for vid peeled centers with highly repetitive ecological situation.

Space Vehicle Swivelator

Difficulties to the American Astronautical Society meeting heard. Walter Kaulage of Martin's Denver Division describe a proposed reaction control swivelator as a flight facility for orbital and space vehicles.

According to Martin studies containing fuel 100% reaction control efficiency is reached at zero ambient pressure, reaction controls become protected at altitudes above approximately 18,000 ft. At ground, an auxiliary reaction control and reaction controls, use as three swivelators which can support additional vehicles upon the subject. A swivelator can only separate conditions of linear acceleration and deceleration in its swivelator is loaded in the initial and final phases of space flight. The last led Kaulage to conclude that a need exists for reaction control devices to qualify and prepare personnel for the activities of orbital and space flight.

Martin has considered the following configurations:

- Gravitally, mechanically supported swivelator. This system was discarded because of the intricate guide lock and because of rapid output problems.
- Hydromechanically supported swivelator. This was rejected because it produced more vibrations in the occupant and would result in bumping and upbore loads offering more serious problems.
- Pneumatically supported swivelator. This appears to reduce the problems associated with the other two types and is more amenable to modifications.

New Swivelator Works

Heart of the swivelator is a 10-ft spool, pneumatically supported on a contained base. Spooler rotates on the outer ring of the base forms a chamber into the center of which air is discharged at pressure. In the static condition, pressure will be equally distributed over the spooler's surface. If more flow is adequate, each about 2 psi pressure is required for the initial flow. Pressure distribution then changes over to the dynamic characteristics of the mass flow. This resistance in the rotation of the spooler by the air bearing support is a function of negligible value. However, the spooler itself will be completely free

from the base, to permit uncontrolled rotation. Impulses of the shell is the significant factor. An inherent in this respect increases, as bearing system resists about parallelly. Only 5 psi bearing is needed of spooler air said. The spooler swivelator weighs about 1,600 lb, including weight of the pilot. Almost any structural material may be used if it is rigid enough to carry the necessary spooler.

Swivelator center of gravity will be over the geometric center of the 54 in diameter base. Everything in the spooler will be located so as to maintain near perfect balance. A bearing mechanism with linear actuators will enable the operator to hold the center of gravity of the geometric center of the spooler and will permit adjustment for a certain of gravity displacement to produce rotation on command. Pilot seat will be truck-mounted to enable better move-

ment possible. Pilot can be located with his center of gravity coincident with that of the spooler, or he may be located so that his vertical mechanism can be located at the center of the spooler. This last position would permit physiological testing for weightlessness. Importance of stability (internal) two stability for weightless space flight is unknown but must be determined by crew selection. Seat must be counterbalanced to compensate for this change in position.

The swivelator requires a specially designed seat with head and knee supports at right angles to eliminate sliding in seat position. Basic selection allows only slowest head movement and hand movement below the waist. If the light strapped occupant passes through the inverted position, relative pressure changes in the head is expected to be reduced. This should contribute to



Atlas Ablative Nose Cone Shows Re-Entry Effects

Recovered Atlas B-2 nose cone built by General Electric Co. is prepared for post-recovery inspection. Ablative material on representative nose cone showed back during test of re-entry USAF/Danvers Atlas B-2 flew 6,500 mi. (AW July 27, p. 40)

decomposition of the occupant. Emergency release system to free the occupant if he can escape is achieved by a padlock on the right arm rest. The rest of the body restraints must be released manually. The hand grips help him leave the air aloft if it comes to rest in a non-level position.

Simulator control unit is located under the occupant's right hand and requires only fingertip manipulation. Stick controls positive and negative maneuvers about all three axes. Stick movements for pitch and roll control are conventional. Yaw is produced by rotation of the stick about its own axis. Proportional control response is preferred to the "bang-bang" type for vi-

near control because it is subjected to fuel whether spin or lag effects, which should be used.

Twelve motion units are mounted flush on the surface of the sphere. Only seven are needed to produce any congealed rotation but the duplication was made necessary by torque problems in the first Bristow jet unit. It is closed by a electric switch before entering the base while another in the opposite side of the sphere is opened. If a jet were permitted to rotate within the base it would disturb the mass flow of the support and change its own thrust due to the aerobatic conditions. Mission programs for evaluation, selection and training tasks can either be entered on board or transmitted into the simulator

by radio. No wind corrections are possible.

Control system can be modified to simulate specific dynamic characteristics of a given capsule or vehicle.

Communication between the occupant and the outside operator can be made possible by light mounted in an equatorial in the surface of the shell and infrared or miniature short conductor can be used for telemetry.

A roller-type readout and direction indicator can be used to record the test man's rotation. Closed-circuit television will be a later addition. Orientation of the base into the sky requires angular velocity at which the sphere can be rotated. With the 50-in. base, the rotations limits the base to 30 rpm. Should the air bearing collapse at less than 25 rpm, there would be no damage of the sphere rolling off the base. A large diameter base would permit more rapid rotation; however, 30 rpm is more than that expected in orbit or spin maneuvers. If the bearing collapses, the simulator can be rotated to clear the base by an emergency cylinder of air or nitrogen.

Simulator Projects

Part of the possible projects for the simulator would be to determine the limitations of man in certain maneuvers and conditions. Controlled development of various of environmental phenomena such as pressure, hypoxia, CO₂ content, temperature and lighting conditions would show their respective effects on pilot capabilities. Later it would be used for crew selection and training programs. The simulator bench itself could be modified and many other maneuvers may be tested. For instance it would be possible to make a selected navigation device of the surrounding the simulator with a plane, known device. The base surface could also be finished in dull black and fitted with simulated stars to give the appearance of starry firmament. The base unit can be used for evaluating control systems, instruments, and equipment under pseudo independent conditions by continuously changing the direction of the jets.

Rear Adm. Jack P. Monroe, Pacific Missile Range commander, told a dinner meeting of the AAS the reasons for Navy interest in space.

Adm. Monroe pointed the withering of any service which has specific role and the Navy's aim is to use space to accomplish naval warfare objectives and to prevent it from being used to the detriment of those objectives. There is no doubt that the capability of space will be a factor in the future of the world, but will influence directly the manner in which Navy performs its job of controlling the sea, he said.

BUSINESS FLYING



BUSINESS AIRCRAFT fleet operated by Pacific Aeronautics Products, Inc., includes (l to r): Boeing 707, Boeing 747, Boeing 719, two Beech Bonanzas. Variety of types means there is always one to use in replacement on a job for which another is better adapted.

Air Fleet Saves Time, Builds Prestige

Gillette, Calif.—A fleet-type business plane fleet is used by electrical cable manufacturer Pacific Aeronautics Products, Inc., to keep pace with its rapidly growing and expanding operations, which frequently require immediate maintenance and often key their orders to quick delivery schedules.

Tight schedules require that Pacific Aeronautics President Arthur F. Jauch and his engineers stay on the move, not only to close contracts, but also to investigate the customer's problems and help in installation of the cable. With orders often depending upon delivery on 24-hr. notice, time can make or lose a contract, because a critical factor in meeting schedules.

Time Factor

Cables and cable harness used in the outside industry frequently must be designed to incorporate special controls and surface to highly specified electrical properties. Production runs are short.

Average order is for 100 to 500 cable harness. To maintain this pace, over a million dollars must be tied up in raw materials inventory and at least two thirds must be kept operating in engineering and production. This means that time on order for an unrelenting or installing customer can form a large part of the total time from order to cash in delivery. That loss is extremely costly.

The Pacific Aeronautics fleet includes a Beech E-18 Twin-Bonanza, an F-13 Bonanza, one of the original Model 35 Bonanzas, a Cessna 441, and a Mustang 212D two-place biplane. The company's flight department also serves Space Electronics Corp. (AW May 18, p. 16), a subsidiary, and Radio Corp.

of Arcata, from which Pacific Aeronautics holds a subcontract for instrumentations at Vandenberg AFB, Calif. A fee charged to outside users of the fleet is calculated to cover costs of the service and no more. The company takes its profit in prestige and good will.

The Twin-Bonanza is used to provide scheduled taxi from Gillette to Vandenberg AFB. Santa Monica is the location field from which to provide service for RCA. Unscheduled stops are occasionally made at Pacific Missile Range Headquarters, NMIC, Ft. Meigs. The school ship type can maintain mail and light cargo as well in general. An extra Twin-Bonanza or Avia Commander is sometimes rented to put a second crew on the scheduled run when traffic is very heavy. This happens on average twice a month. Of Pacific Aeronautics' over 900 employees, a single day may see 300 at Vandenberg and adjacent Naval Missile Facility, Ft. Aguirre.

The little Mustang is used for courier work as to carry a single high priority passenger. It and the other single-engine aircraft often serve Santa Monica and other nearby and airports in Berkeley or Los Angeles International Airport to catch commercial airline flights when that is more economical than going all the way to company airport. This reduces the cost of a single business day by saving long trips through Los Angeles traffic.

About 95% of the time, the decision about what type of transportation to use is made by a full-time travel clerk in the accounting department who also provides letters with the Flight Office. Decisions are usually based on a comparison of the costs but if the company fleet

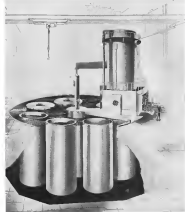
can deliver the passenger to his destination substantially quicker than commercial cost and time is at a premium, cost may be overlooked. On rare occasions, fleets or other high company officials can make the travel clerk to obtain some competitive advantage in reducing the pricing which the fleet costs.

Pacific Aeronautics' accounting office considers the controlled control of travel an important factor in the possible operation of the company fleet. As well as avoiding unnecessary use of the airplanes, it reduces the high cost of all the airplanes in active being stored when they are needed for some specific remaining trip.

Fleet Near Airport

One factor which obviously contributes to profitability of the Pacific Aeronautics fleet is the location of the plant at privately owned Grand Central Airport here. This factor will probably be duplicated this month when Grand Central will be closed under municipal support can be found. Neither Pacific nor Grand Central pay rates except to the extent that the pattern of fleet operation runs to the pattern of fleet operation runs to the pattern. The company is now considering purchase of a helicopter to provide delivery to flight base headquarters and Cots has picked up a helicopter because Pacific Aeronautics has not yet decided which airport it will want to use, but the decision seems a likely choice.

Particularly in tight competitive situations, Jacob believes that, undoubtedly, available transportation is an important asset to give up in his business. He cites the time when Pacific Aeronautics was building on an important missile control vehicle contract. The job called for a big, specialized production man-



Furnace Heat-Treats Rocket Casings

Heat treatment facility now being built for General Electric's Rocket Engine Section at Dayton, Ohio, will heat-treat solid propellant rocket casings up to 30 ft. long and 30 ft. diameter. Facility, which will cost about \$1 million, will be operational next March and later will be expanded to handle 60 ft. casings. Unit consists of spark gap and several 1500F heaters arranged in a circle below heat bath. A 2500F furnace will be three feet long, operating on a centrally-heated pipe and sitting on a crawler track. Rocket casings first are heated to 900F in a pit furnace and then loaded onto the heat-bath furnace for heating at higher temperatures. After treatment, motor casing is loaded into a quench pit and then transferred to another lower level furnace for final tempering.



**THE
MILITARY
REQUIREMENTS
FOR
MOON BASE**

This is the title of one of four major space proposals developed by Martin for the military and aerospace branches of our Government. The importance of this proposal is two fold: the inevitability of an orbital space base program by this country within the next 5 years, and; the fact that we could not can under take such a project now — not in theory but in "hard" engineering design. For Martin's eight divisions add up to one of the top capabilities in the free world for man's first ventures in space-planetary exploration,

MARTIN
BALTIMORE-DENVER-ORLANDO

close to hard metal docking over the conductive handle and inner layer of insulation. Neither Pacific Automation nor its competitors had such a machine but one was available in Spokane, Wash. At 8 a.m. four were loaded the Van Broun with Ron Cate. This was experts from engineering, purchasing, manufacturing and plant engineering departments. Five hours later they landed at Spokane where a motel car waited at the flight line. The four experts drove away immediately while Cate filed out the rental agency's form and had the loc filled to his own credit card.

When they returned at home-and-a-half later, the leading machine he hoped to Pacific Automation and was being packaged for shipment. Cate had the machine loaded and his luggage was aboard. At 5:30 p.m., the four were back in the Glendale, Calif., plant finishing up the Pacific Automation proposal.

An unexpected advantage of company-owned assets in this type of operation is privacy. In a high pressure situation, such as the Spokane trip, necessary facts need not be hung out. Conferences can be held, decisions arrived at and paper work completed during the flight.

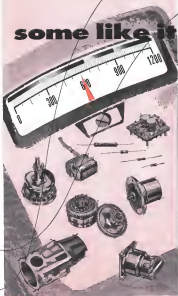
Fleet Economics

The economies of company fleet operation are sometimes surprising. Occasionally, Pacific Automation has broken drivers to Vandenberg to pick up trucks and drive them back to Glendale. This is highly profitable because the drivers own gas dues and the machine drive each way would make it an overnight operation in an aerial transportation. They can be fitted in so the scheduled morning flights on a space-available basis without incurring an significant costs at all.

Pacific Automation Flight Department logs in nearly 250 hr and 418 landings per month. Time between trips averages about 40 min. Pilot availability rather than aircraft availability sets the capacity of the company's flight department. For its six employees, it has only five full time pilots and two amateurs who is some times available when traffic is heavy. This is due at least partly to the difficulty of finding people who meet the qualifications. Besides the basic requirements of commercial or air transport rating and instrument rating, Pacific Automation pilots must meet quite high personal standards because they must withstand motion sickness and anxiety of the company and must often put their own flying services on standby, business manager and services.

In addition the pilots do nearly all their own company paperwork, without benefit of a technical staff and position

some like it **HOT**



Sundstrand secondary power systems and components for 100° F operation have been proved through comprehensive research and environmental testing in the following areas:

MECHANICAL

Mechanical
Evaluation and testing of new materials and designs for such components as assemblies and journal bearings, gears, bearings, springs, seals, valves, pressure switches, etc.

HYDRAULIC

Hydraulic
Comprehensive evaluation of some 20 fluids possessing varied ranges of viscosity and thermal stability; hydraulic testing, including constant applications of up to 3000 psi, and complete endurance testing to more than 100 hours.

ELECTRICAL

Electrical
Evaluation and testing of new materials and designs for such components as resistors, capacitors, inductors, transformers, power transistors, potentiometers, relays, solenoids, diodes, and transistors.



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all the manufacturers on the market except 100 in checks. One of the pilots of the test aircrafts and one of a Federal Aviation Agency designated Aircraft Maintenance Inspectors. The two pilots who had ground ratings have both earned and maintained records of their own. The airplane is not in Beech's distributor Norman Larson at

Von New report for 19011 checks between 19011 and 19011, the idea of having an outside agency checking the quality of maintenance. It is a change in the way the plane is checked. The change is that Pacific Aeronautics can make a 100,000 check in less than a year from the factory of operators' dis-

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SWISSAIR-PHOTO's Do 27 is being modified to enlarge photographic capabilities.

Swissair-Photo Expands Activities To Enter Government Map Work

By Edith Walker

Zürich, Switzerland—Sharp increase in need for aerial photography is leading to expansion in Swissair-Photo AG's activities to permit it to share the government's aerial survey work. Work will extend services of aerial photography, including mapping, hydrographic and other development schemes for the government and private companies. This program is considered only the first step in the company's expansion—approximately two years it plans to extend its services outside Switzerland to other European countries.

Survey Orders

Swissair-Photo received a firm agreement with the Swiss government in March to handle, prepare, furnish and deliver to the Swiss Federal Survey and Topographic Department in Bern. Orders for aerial survey have increased so rapidly in recent years that the government department asked Swissair-Photo for its assistance.

In the future, the Federal Survey and Topographic Department will only undertake government aerial surveys with its Swissair-Photo. This project would be brought into force for the purpose. All other orders will be turned over to Swissair-Photo AG.

So far, the company's activities con-

centric and aerial shots for its general company's government aerial work in aerial, land, boundaries and points. It also worked on order from private companies for aerial and photographic work for educational, industrial and land planning purposes, geographic and other for tourist offices, private, particularly date newspaper and book illustrations. Latest published travel book, "Across the Alps," took Swissair-Photo AG a year to complete. Using a

As Do 27's Munich works, the aircraft is at present being fitted with larger cabin windows, additional fuel tanks for extra hours flying time, and a radio, but no kind of night flying instrument will be installed. Ultimate version of the plane fully equipped to Swissair-Photo's specifications will be approximately \$15,000 instead of the \$20,000 price of the standard Do 27 model.

Order of points of the company plan to extend for the addition of the plane is now kind of aerial survey work, transport of light range for Swissair, business flying of Swissair countries, military duty from one hour support to another (Do 27 can accommodate two stretchers) and technical requirements.

Additional, and probably more, new to be installed will be needed for the next step, as the company's development is expected among those of future order and the Do 27's recently modified Do 28, which is in first appearance of the next year as shown, the 111 was P. 148 or P. 146, or the Swissair-Photo light plane, which



New Version of Soviet A-13 Glider

New model of the Soviet A-13 glider has a V-tail and retractable landing gear. Gross weight is about 700 lb. Soviets say the glider can do landings and several flights.

BIG NOISE FROM SAN CARLOS



BARRATRON is a proprietary brand name for a proprietary product...our powerful new ECM weapon. It is the electronic industry's newest high power transmitting tube, a self-modulating noise generator. Here are most of the facts permitted to be made public. You can (1) extrapolate from these; (2) if you have a need-to-know, send posthaste for our Barratron brochure; (3) come to San Carlos and see for yourself a quite amazing generation of white noise. This is really big!

We make Barratron tubes in either tunable or fixed tuned versions. Both provide broad band white noise, and both are finding their principal applications in present and proposed ECM jamsters.

The tunable version is physically and electrically interchangeable with CW magnetrons now installed in chameleon systems. An added advantage, beyond the incredible increase in quality of the jamming signal, is that the tunable version does not require a modulator, and does not require a noise generator chassis. We are conservative when we say that the white noise emanating from a Litton Barratron tube is ten times more effective for jamming than the power from a CW magnetron. The tunable Barratron tube, then, is designed to upgrade

present systems at minimal cost. We are prepared to replace every CW magnetron jammer in existence with this tube.

The fixed tuned Barratron tubes are intended for new systems. They eliminate the need for tuning circuitry or modulators. They are the ultimate in jamming tubes producible at the present time in quantity with reliability. They permit the development of barrage jamming power in systems small enough and light enough for airborne use. They permit truly simultaneous, continuous barrage over any bands you choose, and they permit all this while functioning unattended and automatically.

If you are hesitating because of sophistication you have heard about or have seen in prototype form, hesitate no longer. Those are all deviously tricky to make, expensive, and everybody has a lot more to learn about them. Meanwhile the Barratron tube is here, ready to cover frequency bands from UHF well into the microwaves and at a cost that is hardly more than a magnetron's.

Our Barratron people will answer any questions you have. Write, or get to the head of the line by sending a telegram. Litton Industries Electron Tube Division, Office A-7, 986 Industrial Road, San Carlos, California.



LITTON INDUSTRIES Electron Tube Division

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TUBES • VACUUM DEVICES • SPECIAL ELECTRONIC TUBES • SPECIAL ELECTRONIC TUBES • SPECIAL ELECTRONIC TUBES • SPECIAL ELECTRONIC TUBES • SPECIAL ELECTRONIC TUBES

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CAN SAVE YOU HUNDREDS
OF SPECIALIZED MAN-HOURS in solving
critical thermal control problems

is easy to find.

sophisticated problem:

APP. TEMP. CONTROLS IN MATHS 2 MANSION CRAFT

Modul:
absolute accuracy under severe G-conditions, light weight, safety in case of electrical failure, accuracy throughout a wide ambient temperature spectrum, low initial cost, simple maintenance, interchangeable parts for 3 complete set-top systems, cable temperature pressure and electronic measurement



DUCT TEMPERATURE SENSOR
One of many types made by Vapo, including thermocouples, wire-wound resistance-temperature pack-ups, wet-wet contact thermocouples, or the new MICROSIL.

VALVE AND ACTUATOR. Two types: ON-OFF or full-modulating, variable opening. Considerably lighter and smaller than electric valves, lighter than other pneumatic valves. Provides accurate hot and cold air proportioning. Other control designs available for maximum coverage and rugged light weight.

CONTROLLER
Assesses or monitors personnel
Magna Amphib Pumps Control
by use of computer circuitry,
pumps, sensors, and machines
Bdry, simple, rugged, reliable

CALL ON RAY-RIE FOR SYSTEMS ENGINEERING AND WHATEVER A TEMPERATURE CONTROL PROBLEM ARISES.

AIR TEMPERATURE Instruments & elements: air-temperature, color, cooling, wet/dry, and wind speed.

LIQUID TEMPERATURE. All liquids, including fuel systems, batteries, natural refrigerants, H_2O , acids

SURFACE TEMPERATURE And-ong do-ong so-
 o-lye pumyeo hae myeongyeo, geumyeo, almyeong,
 saengyeo hae myeongyeo myeongyeo

Describe damage and greatest anxiety for those who drop the fight.
Write on your forehead, specify type of equipment or nature of problem.

VAP-AIR
The Associated Division of
VAPOR HEATING CORPORATION
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Tupper Newburg (Cassidy) Lanes
2000 Louisa Ave., Mount 26, Quebec



They rise suddenly, hence, threatened bottom. Note addition of 185 gal. to tank.

Temps II Design

Estimated Performance:
 Cruising range at speed of 33,000 ft at 31,600 ft g.p.s. 47½ hours
 power 519 hp
 Stall speed at 35,500 ft. 5½ g.p.s.
 Range and speed extended 7½ g.p.s.
 Rate of climb at sea level, 35,000 ft. g.p.s. maintains constant 1,670 ft/min
 Rate of climb at 5,000 ft. at 35,000 ft g.p.s., critical regime in operation and propeller faultless
 prop. streaming engine at max. loads continuous power 560 hp
 Economy equivalent (S.M.A.E.) at sea level 51,600 ft g.p.s., standard is 4,110 ft
 Load over 10 ft. altitude at sea level, 51,600 ft g.p.s., standard is 5,300

Weights	
Maximum takeoff gross	15 080 lb
Maximum landing gross	10 080 lb
Empty weight less oil and crew	23 080 lb
Structural design specs. (TAS)	
Never exceed	325 mph
Diving	345 mph
Flap down	205 mph
Cut down	165 mph

Type	71 ft 4 in
Length	60 ft 12 in
Height	28 ft 6 in
Wing span	55 ft 4 in
Feeding width (maximum)	5 ft 2 in
Feeding height (maximum)	7 ft 6 in
Feeding length	60 ft 11 in
Loading gate travel	21 ft 11 in
Wheel base	15 ft 4 in

Wing tanks	500 gal
Center wing panel tanks (optional)	300 gal
Wing tip tanks	370 gal
Total capacity	1,170 gal



Fairchild Engine & Airplane Corp. will manufacture Unithough 15-caterpillar engine under a subcontract from Unithough Aircraft Corp. Trading will get order w/o. more details; aircraft will sell for \$9,995. Forward motion is obtained by pusher propeller driven by Leaning 140-hp engine. Three-bladed water propeller 40" and can be slanted into engine for vertical thrust. Prototype now in engineering tests at Fairchild's Elmhurst, Ill., plant.

MISSILE ENGINEERING



Astrodyne solid rocket motor, 41,000 lb thrust during test firing at McGowan, Tex., facility. Unit produced pressure-time curve exactly as predicted, company said.

Astrodyne Builds Solid Rocket Motor

Large solid propellant-fueled rocket motor, successfully fired by Astrodyne, Inc., at McGowan, Tex., produced 41,000 lb thrust and a specific impulse which the company said compared "one favorably" with the most powerful solid propellant now under development in the solid rocket industry. Motor used an innovative propellant chamber design and a modified XM-54 rocket case and contained 40 times more propellant than any other Astrodyne had previously fired. The XM-54 case was used for the historic Astrodyne produced to launch a North American F-100 jet fighter. The case is 36 ft. long and 27 in. in diameter. A new aft head with a smaller throat nozzle was designed for the case. The aft end of the case and the aft head were coated with a new Astrodyne-developed insulation that protected them from the 5,000 deg. F. temperatures. Insulation thickness varied from 1/8 in. to 1/4 in.



Propellant casing, case is lowered into a pit for the pouring operation. The case holds approximately 1,200 lb of propellant and is water-purified to aid in maintaining the proper propellant temperature. Unit is transported in a facility with special slatways.



Quality and consistency of propellant is checked as it is poured into casting can.



Trickling plan, casting can on top of the discharging valve and controls are dropped into the rocket case below.



Rocket case is lowered into casting pit (left) in preparation for pouring; motor is cast in pit for 72 hr. at 87°F after final press. At right, air-dried material is passed for insertion into the case. Mended is coated with Teflon, which acts as a lubricant.



Mended is loaded into place ready for the start of the casting operation. Unit was grouted from forward end (left) and core is at left; and tapered nozzle/nozzle, along all surfaces and aft end. At right, new direction case shows full 35 ft. change.



All head is placed in assembly to relieve surface head evolution as inside (left). At center, the rocket motor has been removed from casting pit for application of the inside assembly. Speed pg (right) is used to shape the head inside in rocket case.

For functions of rotating speed . . . **CONTROL** with the new AC Speed Monitor!

APPLICATIONS

- Engine starting cycle control
 - Ignition and ignition cut-off
- Engine starter cut-off
 - Clutch control
- Entrance guide ramp positioning
 - Blind valve control
- Overspeed protection
 - Underspeed protection



SPARK PLUG • THE ELECTRONICS DIVISION OF GENERAL MOTORS



The AC Speed Monitor triggers engine and machine functions more accurately and dependably than any device now on the market. And it's applicable to both military and industrial equipment.

It's so sensitive that it opens and closes electrical contacts in two snap-action switches within a tolerance of 1/10 of speed settings. The speed range is 500 to 3600 rpm. Within that range AC Speed Monitors can be adjusted to your exact requirements. When more than two switches are desired, AC Speed Monitors can be cabled in tandem.

All of this performance is designed into a one-pound package that's less than three inches in any dimension—for mounting almost anywhere. Yet the AC Speed Monitor is ruggedly built and permanently lubricated for thousands of hours of life, proved by severe laboratory environmental tests and actual field conditions.

If you have need for this superb automatic device, and wish more details sheet it, or AC Fuel Controls, contact the Director of Sales, AC Spark Plug—the Electronics Division of General Motors, Milwaukee, Wisconsin.

EQUIPMENT

ARDC Tests Remote-Controlled Sweeper

Remote-controlled decontamination sweep sweeper is undergoing tests by USAF's Air Research and Development Command for use in cleanup operations following a nuclear explosion.

The sweeper, which can be driven continuously for duty sweep cleaning, could be remotely controlled to avoid exposing personnel to radioactivity in cleanup of fallout debris from a nuclear attack, or an accidental nuclear explosion. The Air Force says that even with utmost precaution and elaborate safety devices, the probability of a peaceful nuclear accident occurring directly with increased number of flights with the sweeper. AE Air Force tests have tested sweeping debris with aircraft accidents with nuclear weapons aboard.

Air Force Special Weapons Center, ARDC, Kirtland AFB, N. M. will test the sweeper, which was produced by the G. H. Loomis Co., Minneapolis, Minn. After tests, looking about one year, the Air Force will contract for production of the vehicle.

Television Use

Television camera fitted to the vehicle will permit radio controlled operation from distances up to 10 mi. At present, the brush sweeper is controlled from an electronic remote control panel to demonstrate its remote control capabilities. The operator, using the control panel, can perform the following operations: start the engine, adjust the throttle, brake, shift gear (low forward, one reverse) control brush pressure or (vacuum, discharge) dust from the vacuum filter, turn right or left and dump the 4 cu yd hopper.

One of the three dual-mounted television cameras will pitch 360 deg and will have a zoom lens focusing to 10 in. If necessary, the sweeper will be equipped with remote cooling device to prevent overheating of the electron tubes during extended operation.

In operation, the sweeper will be equipped with Geiger counters and other radiation detection devices and will indicate series of high intensity radiation.

Monitors on the sweeper will broadcast engine sounds to the radio truck along with the television picture. This will aid the operator in detecting engine malfunctions and engine load of the machine. Switch located on the sweeper vehicle is a vacuum brake which operates upon loss of the radio control signal.



REMOTE control capability of decontamination sweeper is demonstrated with electronically actuated control panel. Vehicle will be radio controlled.



SWEOPER demonstrates an 800-cubic yard hopper dumping operation. The 4 cu. yd. hopper is lifted to full height three times to discharge all material.

The 10-ton vehicle cleans a path 87 in. wide and can sweep at a maximum speed of 15 mph. Most efficient sweeping speed, however, is approximately 15 mph at which anticipated efficiency is 99% in sweeping up per girth, full cut debris and remove soilage.

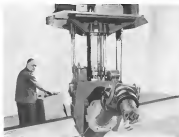
The dirt pickup system utilizes a rotating brush which rotates at a slow initial speed. Air jets are used to blow loose dirt particles into the main vacuum system. The dust laden air is filtered through a fine screen filter which can be remotely adjusted to deposit the radioactive dust into the main hopper.

Zooming the sweeper are two 100

hp 61 hp engines. One engine powers the brush and the other powers the rotating brush, vacuum fan, jet blowers and the 25 x generators. The Air Force also is considering the possibility of using remote controlled bulldozers which would clean up heavy debris before using the decontamination truck.

In addition to cleaning main, heavy debris, the bulldozers could be used to dig disposal pits for radioactive dust and dirt. After cleaning up the fallout material, the radio controlled vehicles would be driven to a remote area and allowed to "cool" until they can be approached by personnel.

NEW AVIATION PRODUCTS



Mechanical Arm for Project Rover

General Mills Mechanical Division is completing tests of a mechanical arm for use in connection with Project Rover nuclear propulsion studies in University of California's Scientific Laboratory. Capable of lifting 5,000 lb., will be used in future development work at Nevada Test Site (AW May 4, p. 38).



Flow Control Servovalves

Mechanical feedback, electrohydraulic servovalves are designed for aircraft and missile flight control systems and industrial control installations.

Valves are available in Series 11 and 12, which differ in that Series 12 has a larger hydraulic port and a second-stage sliding spool permitting greater maximum flow. The Series 11 has a higher dynamic response. Minimum rated flow at a 1,000 psi valve pressure drop is 4 gpm for Series 11 and 5 gpm for Series 12 at 5,000 psi drop, max.



Series rated flow is 7 and 14 gpm, respectively. Operating supply pressure is 10 to 4,000 psi. Temperature range (fluid and ambient) is -65 to +350°F standard, to 500°F on special order. Weight is 9.75 lb.

Morgan Servovalves, Inc., E. Aurora, N. Y.

Fuel Gage Tester

Expendable-type fuel quantity gage tester is said to be 15% lighter and 50% smaller than previous models.

Type 1429-A fuel gage tester contains a pair of 3-horsepower air compressors, one through which flow 20 to 270 scf (approximately) one to simulate the jet fuel compressor, the other in conjunction with fuel solvent meter orifice, to simulate the more stringent capacities of the fuel gage. To maintain accuracy, the compressors are enclosed in a shock-proof aluminum case measuring 18 1/2 x 17 1/2 x 16 1/2 in.

General Radio Co., West Concord, Mass.

Pressure Switch

Absolute pressure electrical switch, designed to operate contact and warning systems in aircraft and missiles, has one moving part.

Pneumatic, Model 655, consists of two precision metal contacts within an evacuated hermetically sealed chamber and is encased in a thermosetting plastic housing. One contact is welded to a No. 300 sensing diaphragm that operates in outside pressure changes. Switch specifications include weight



1.2 oz., temperature range -65 to +250°C, pressure range 2 to 14.7 psi or sea level to 30,000 ft altitude; proof pressure 0 to 35 psi. Contact current taking is dependent on application, max. current performance at 0.5 amp, maximum at 28 v.

Price Information Division, Bendix Aviation Corp., 1400 Taylor Ave., Bala Cynwyd 4, Pa.

Turbine Control System

Turbine engine control system is designed for gas turbine engines in the 100 to 750 hp range.

Control system consists of three components: a main fuel control, a power turbine governor for free turbine engines, and an optional air temperature compensator. Total weight of the three

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Where single convolution and synthetic tubing can't do the job, this all-metal hose, formed by BREEZE exclusive DYNAMIC convolution process will solve the most exacting high performance problems. Here are the advanced features:

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components is less than 4 lb. On applications where all three components are not required, custom weight models are fabricated. System is designed to fit all small gas turbine engines.

Engine Equipment Section, Product Products Division, South Bend 20, Ind.

WHAT'S NEW

Reports Available:

The following reports are sponsored by the Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

Heat Transfer to Boundary Layers With Passive Conductions. R. A. Seely and H. W. Chan. University of California for Wright Air Development Center, U. S. Air Force, May, 1958. \$2.25. 97 pp. (PB 151-644.)

Associated Bibliography of Applied Physical Anthropology in Human Engineering. R. B. Haines and D. T. Canning, 18 E. 2nd St., New York, N. Y. 10003. U. S. Air Force, May, 1958. \$5.00. 311 pp. (PB 151-487.)

Human Pilot Dynamic Response in Flight and Simulator. In E. Sedel and I. A. Hall, Princeton University, and D. T. McFarland and D. H. West. Control Systems, Inc. for Wright Air Development Center, U. S. Air Force, Aug. 1958. \$8.75. 68 pp. (PB 151-501.)

Bibliography of Technical Reports on the Effects of Fallout. By R. Wilbur, University of California Radiation Laboratory for the Atomic Energy Commission, Feb., 1958. \$2.00. 70 pp. (UCRL 5413.)

Reports of Capital Research. Three new reports dealing with research on metals can be obtained at \$10 each from GTS. Part I, 1958-1959 includes gas turbines, aluminum, and other metals; Part II, 1958-1959 includes metal fabrication and structures; Part III, 1958-1959 includes quartz and other piezoelectric materials; growth and synthetic crystals.

Development of An Improved Air Force Single-Use Jet. J. A. Hirsch, Wright Air Development Center, U. S. Air Force, August 1958. \$5.50. 14 pp. (PB 151-696.)



Navy Portable Jet Engine Tester

Portable jet engine test system has been developed for the Navy by Sperry Corp. System has a capacity of 30,000 lb. thrust and can provide complete fuel/air and speed control testing on any jet engine the Navy has in service. Trailer shows how engine is fuel tank, auxiliary power unit and manual/automatic control unit. Engine is mounted on a second trailer. Only ground work required is connection for a thrust measuring device.

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Here's how you can save design, development and production costs. G.E.'s transistorized C-Band Beacon, originally designed and tested in a spaceborne tracking aid for better weather applications, is now available for tracking and identification of all types of missiles, drones and aircraft. Remarkably compact (9.8 lbs., 9.53 x 7.08 x 3.87 inches), G.E.'s transistorized C-Band Beacon offers you such outstanding advantages as a guaranteed 100,000 Peak Power Output with extremely Low Power Consumption, Precision Reliability in a Single Package (Power Supply Included), and Single or Double Pulse Interoperation. And, this Beacon is available within four months of your order. Get more information today about this unusual beacon package.

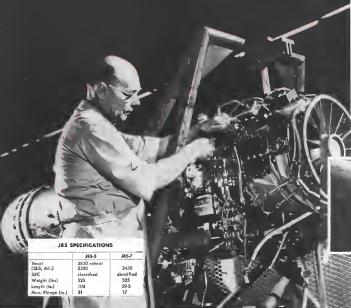
*Weight is quantity of 10, 30-watt power Air Logic Generator.

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Smaller, lighter, 3850 lbs reheat thrust.....



J85 SPECIFICATIONS

	J85-3	J85-7
Thrust (SEA, MIL-2)	2830 reheat	2450
SFC	classified	classified
Weight (lbs)	325	325
Length (in.)	104	99.9
Area, Wing (sq. in.)	21	17

General Electric J85 engines are now in production at the Company's Small Aircraft Engine Dept., Lynn, Mass.

NEW General Electric J85 turbojet helps reduce airframe size, weight, cost... boosts mission performance

SMALLER AND LIGHTER than comparable turbojets, General Electric's new J85 reduces airframe size, makes possible significant savings in airframe weight, corresponding reductions in airframe costs.

RATED AT 3850 LBS REHEAT THRUST, and 3300 lbs dry thrust, the J85-3 weighs only 325 lbs. Its missile counterpart, the J85-7, delivers 2450 lbs thrust... weighs only 325 lbs.

SHORT AND COMPACT, with a better than 7 to 1 throat-to-nose ratio and low SFC, the J85 makes possible greater mission capabilities.

PERFORMANCE PROVEN, the J85 has accumulated more than 6000 test hours. On North American's T-38 utility transport, individual prototype (90-lb) YJ85's have logged over 88 hours of engine flight time before overhaul.

DURING ALTITUDE TESTS at Arnold Engineering Development Center, the J85 has exceeded thrust and SFC guarantees. At Wright Air Development Center rugged environmental tests have demonstrated the J85's low temperature starting and accelerating characteristics.

THESE EXAMPLES are typical of the rigorous flight, field and factory tests that have verified J85 ruggedness, reliability and safety margins.

The J85 has been developed under USAF contract and is now in production.

A NEW CASSEGRAIN BROCHURE that describes General Electric's J85 engine is now available. For your copy, write James 310-31, General Electric Company, Schenectady, N. Y.



AUTOMOBILE'S SHAWT BODY MODEL, powered by General Electric's J85, will give the U.S. one of today's most effective downcountry weapons. The SHAWT is shown above being hoisted from a B-27 during flight test.



NOVEMBER'S AL-119F "FREEDOM FIGHTER" and T-38 "TACON" TRAINER-950. Subsequently, several General Electric J85 engines, their high performance, low cost and other significant airframe size and weight savings.

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